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TIPS TRICKS & APPS & HACKS

VOLUME 3

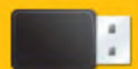










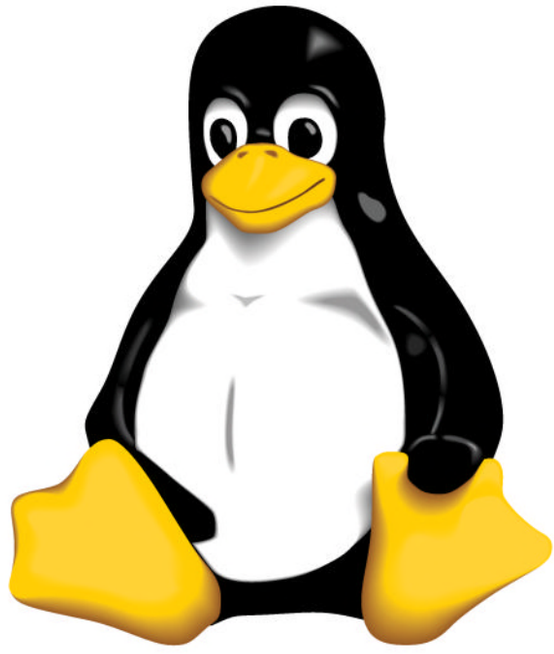


```
import picam
import time
ii = picam
takePhotoWithDetails(640,480, 85)
filename = "/tmp/picam-%s.jpg" % time.
strftime("%Y%m%d-%H%M%S")
ii.save(filename)
```

UNLOCK THE POTENTIAL OF OPEN SOURCE OPERATING SYSTEMS

Welcome to Linux Tips, Tricks, Apps & Hacks

In this new volume of Linux Tips, Tricks, Apps & Hacks, you will find everything you need to bust open your Linux systems and start making them work the way you want them to. The free and customisable philosophy of open source software means it is perfect for anyone who wants to delve beneath the surface and start tinkering with the way things work. In this book, we'll get started with 100 ways to master the command line so you'll never be daunted by the terminal screen again. You'll discover how to build your best ever servers, with increased speeds and functionality, and find out all about this year's best distros and which free software to use with them. With all of these and many more expert tips, tricks and hacks, plus reviews of some of the best Linux software available, this is the perfect guide for everyone who wants to enhance their Linux experience.



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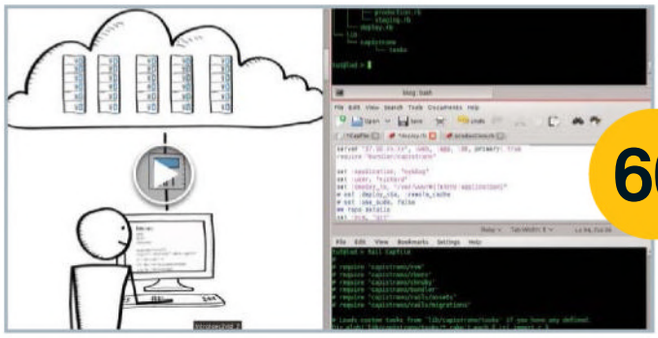
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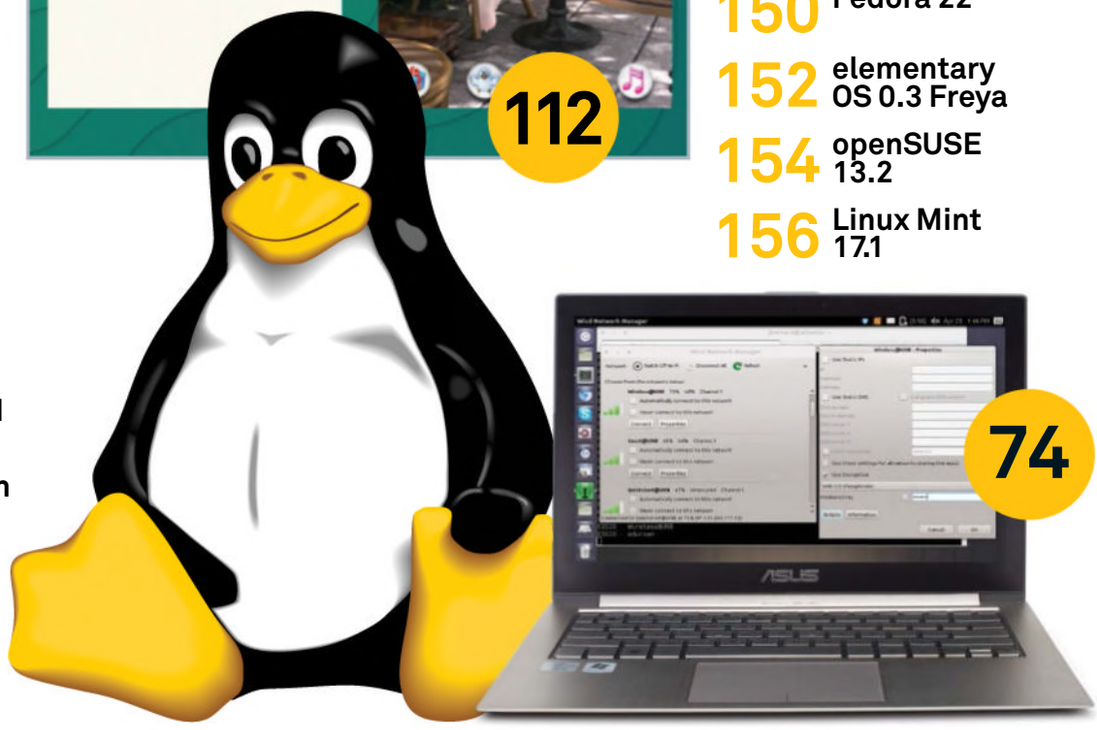
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"Find everything you need to bust open your Linux systems and start making them work the way you want them to"



100 WAYS TO MASTER THE COMMAND LINE

>_Conquer the command line with these essential terminal tips for controlling Linux



Long before desktop environments or graphical interfaces, in the heady days of the Seventies and Eighties, everything was done on a command line. Computing in the Nineties, while generally dominated by graphical interfaces and mice, wasn't quite separated from it and computer users of a certain age will likely remember at the very least using the infamous DOS prompt.

Now programming is well advanced and, even in Linux, you can spend your entire time in the desktop environment and never even touch the command line or terminal if you're using the right distro. Thing is, you'd be doing yourself a disservice by not learning how to make the most of the command line as it can be an extremely powerful tool – especially as a lot of graphical software will have command line controls that you can use as well. So put on your best Nineties outfit, give yourself a bad nickname and get ready to look like a movie hacker.

NEED TO KNOW

>_Get to grips with the terminal before you take on the advanced tools

>_001 ls

You can use **ls** to list the files and folders that are inside the directory you are in.

>_002 cd

The **cd** command enables you to move between directories on your system. Like the following, for example:

```
$ cd /home/user/
```

>_003 cp

The **copy** command, or **cp**, can be used to copy files from one location to another. To do this use the command below:

```
$ cp file /home/user/Desktop/file
```

>_004 mv

Similar to **copy**, **mv** instead moves the file to the new location, deleting the original file:

```
$ mv file /home/user/Desktop/file
```

>_005 rm

The **rm** command is for removing or deleting files and directories. You can use it like:

```
$ rm file
```

>_006 mkdir

You can create directories with the **mkdir** command using something like:

```
$ mkdir folder
```

>_007 nano

Nano is one of the programs that enables you to edit text in files – it's vital for working and editing in the command line. You use it like so:

```
$ nano file
```

>_008 Tab

The Tab key lets you auto-complete commands and file names. Double-tapping will list all objects with a similar name. Auto-completion works for unambiguous file and command names. For example, 'fir' gives you 'firefox' as no other commands begin with 'fir'. If you get multiple hits, keep typing to narrow the selection, then hit Tab again

>_009 Up

Up on the keyboard has the very simple task of enabling you to pull up the last command that was entered, to run it again or edit it.

>_010 Copy text

If you're in the terminal, you may want to copy text output to use somewhere. To do this, you can use: **Ctrl+Alt+C**.

>_011 Paste text

If you've found a command online or need to paste some text into nano, you can enter any text on the clipboard with: **Ctrl+Alt+V**.

>_012 Open terminal

This trick works in a lot of desktop environments: a shortcut for opening the terminal can be done with: **Ctrl+Alt+T**.

>_013 sudo

This lets you do commands as the super user. The super user in this case is root and you just need to add **sudo** to the start of any command.

>_014 Access root

The super user, or root, can also be accessed by logging in as it from the terminal by typing **su**. You can enter the root user password and then run every command as root without having to use **sudo** at all.

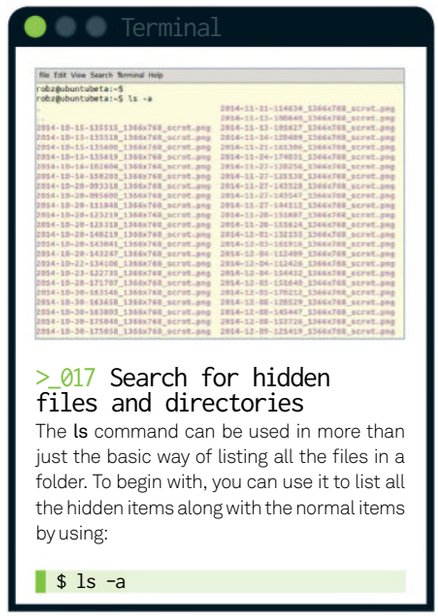
>_015 Stop processes

If you have run a command and either it's paused, taking too long to load, or it's done its job and you don't need to see the rest of it, you can stop it forcefully by using either **Ctrl+C** or **Ctrl+Z**. Remember, only do this if the process is not writing any data, as it is not safe in this instance and you could find yourself in trouble.

>_016 Access root without password

If your regular user is in the sudoers list (ie so that they can use **sudo** in general to run things as root), you can access the su account by using **sudo su**. This uses your normal user password to access root terminal functions.

To add a regular user to the sudoers list, you would need to first log in as the super user by using **su**. Then, you would simply run **adduser username sudo** (replacing 'username'). Be careful who you add to the sudoers list, though!



>_017 Search for hidden files and directories

The **ls** command can be used in more than just the basic way of listing all the files in a folder. To begin with, you can use it to list all the hidden items along with the normal items by using:

```
$ ls -a
```

>_018 Home directory shortcut

The home directory is located at /home/user/ in the absolute filesystem, but you can use the tilde (**~**) to signify the home directory when moving between directories or copying, or doing mostly anything else – like with the following, for example:

```
$ cd ~
```

>_019 Link commands together

If you want to do a series of commands one after the other, like updating and then upgrading software in Debian, for example, you can use **&&** to have a command run right after the one before. For example:

```
$ sudo apt-get update && sudo
apt-get install libreoffice
```

>_020 Long terminal input

Sometimes when using a list or anything else with a long terminal output, you might not be able to read it well. To make it easier to understand, you can send the output to another command, **less**, through the **|** pipe. It works like so:

```
$ ls | less
```

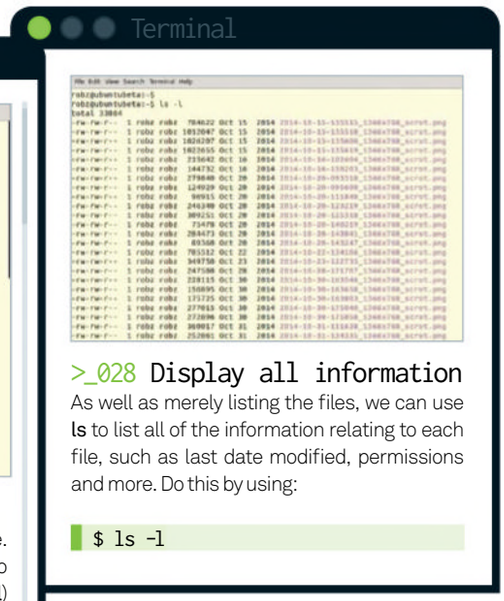
SYSTEM ESSENTIALS

>_Go a step further and learn how to control the terminal that bit better



>_021 Readable storage size

One of the details that **ls -l** displays is the size of the files that are located on the hard drive. This is done in bytes though, which is not always that useful. You can have it parse this file to become more legible simply by changing the **-l** to **-lh**, where the long-listing format option (**-l**) is tweaked with the human-readable option (**-h**).



>_028 Display all information

As well as merely listing the files, we can use **ls** to list all of the information relating to each file, such as last date modified, permissions and more. Do this by using:

```
$ ls -l
```

>_022 Move to previous directory

If you want to move back to the directory that you were working on before, there is a **cd** command to do that easily. This one does not move up the filesystem, but rather back to the last folder that you were in:

```
$ cd -
```

>_023 Move up directory

The **cd** command can also be used to move up in the filesystem. Do this with two full stops, like so:

```
$ cd ..
```

>_024 General wildcards

The asterisk (*) can be used as a wildcard in the terminal to stand for anything. A typical use case is copying or removing specific types of files. For example, if you want to remove all PNG files from a directory, you **cd** to it and type:

```
$ rm *.png
```

>_025 More with the pipe

The pipe (|) can be used to feed all outputs into the next command, enabling you to call a piece of data or string from one command and put it straight into the next command. This works with **grep** and other core Linux tools.

>_026 Delete directories

Using **rm** on a directory with objects within it won't work, as it needs to also delete the files inside. You can modify the **rm** command to delete everything within a directory recursively using:

```
$ rm -r directory
```

>_027 Shutdown command

You can shut down the system from the terminal using the **shutdown** command, the halt option (**-h**), which stops all running programs at the same time, and specifying a time of **now** so it turns off immediately rather than in 60 seconds:

```
$ sudo shutdown -h now
```

>_029 Reboot from command line

Back in the day, rebooting required a slightly more complex shutdown command: **shutdown -r**. In recent years it's been replaced with a very simple:

```
$ sudo reboot
```

>_030 Timed shutdown

The timing function of the **shutdown** command can be very useful if you need to wait for a program or **cron** job to finish before the shutdown occurs. You can use the time to do a normal halt/shutdown, or even with **-r** for a reboot after ten minutes, with something like:

```
$ sudo shutdown -h +10
```

>_031 Log out

Logging out from the x session is generally advisable from the desktop environment, but if you need to log back out to the login manager, you can do this by restarting the display manager. In the case of many Linux distros, you use the command below:

```
$ sudo service lightdm restart
```

INSTALLATION

>_Managing your packages and updating your system is a key part of the command line

>_032 Debian: update repositories

Debian-based (and Ubuntu-based) distros use apt-get as the command line package manager. One of the quirks of apt-get as a package manager is that before upgrading or installing software, it does not check to see if there's a newer version in the repositories. Before doing any installation in Debian, use:

```
$ sudo apt-get update
```

>_033 Debian: install software

Unlike a graphical package manager or software centre, you can't quite search for the kind of packages you want to install, so you need to know the package name before installing. Once you do though, try:

```
$ sudo apt-get install package
```

>_034 Debian: update software

You can upgrade the software in Debian from the terminal by first performing the repository update command in Tip 32, followed by the upgrade command below:

```
$ sudo apt-get upgrade
```

>_035 Debian: uninstall software

As part of package management, apt-get enables you to uninstall software as well. This is simply done by replacing **install** with **remove** in the same command that you would use to install said package (Tip 33). You can also use **purge** instead of remove if you want to delete any config files along with it.

>_036 Debian: upgrade distro

Debian systems can often update to a 'newer version', especially when it's rolling or if there's a new Ubuntu. Sometimes the prompt won't show up, so you can do it in the terminal with:

```
$ sudo apt-get dist-upgrade
```

>_037 Debian: multiple packages

A very simple thing you can do while installing on all platforms is list multiple packages to install at once with the normal installation command. So in Debian it would be:

```
$ sudo apt-get install package1
  package2 package3
```

>_038 Debian: dependencies

Compiling differs between software and they'll each have a guide on how to go about it. One problem you might face is that it will stop until you can find and install the right dependency. You can get around this by installing **auto-apt** and then using it during configuration with:

```
$ sudo auto-apt run ./configure
```

>_039 Debian: force install

Sometimes when installing software, apt-get will refuse to install if specific requirements aren't met (usually in terms of other packages needing to be installed for the software to work properly). You can force the package to install even without the dependencies using:

```
$ sudo apt-get download package
$ sudo dpkg -i package
```

>_040 Debian: install binary

In Tip 39, we used **dpkg -i** to install the binary installer package that we downloaded from the repositories. This same command can be used to install any downloaded binary, either from the repos or from a website.

>_041 Debian: manual force install package

If the advice in Tip 39 is still not working, you can force install with **dpkg**. To do this you just need to add the option **--force-all** to the installation command to ignore any problems, like so:

```
$ sudo dpkg --force-all -i package
```

>_042 Red Hat: update software

Unlike apt-get, the yum package manager for Red Hat/Fedora-based distros does not need you to specifically update the repositories. You can merely update all the software using:

```
$ sudo yum update
```

>_043 Red Hat: install software

Installing with yum is very simple, as long as you know the package name. Yum does have some search facilities though, if you really need to look it up, but once you know what package you want, use the following command:

```
$ sudo yum install package
```

>_044 Red Hat: uninstall software

Yum can also be used to uninstall any package you have on your system, whether you installed it directly from yum or not. As long as you know the package name you can uninstall with:

```
$ sudo yum remove package
```

>_045 Red Hat: force install

The force install function on Red Hat and Fedora-based Linux distros requires that you have a package downloaded and ready to install. You can download things with yum and then force the install with:

```
$ sudo yum install --downloadonly
  --downloaddir=[directory] package
$ sudo rpm -ivh --force package
```

>_046 Red Hat: manual install

RPM is one of the package installers on Red Hat distros and can be used to install downloaded packages. You can either do something like in Tip 45 and download the package from the repos, or download it from the Internet and install with:

```
$ sudo rpm -i package
```

>_047 Red Hat: force manual installation

As in Tip 45, you can use RPM to force install packages if there's a dependency issue or something else wrong with any other packages that you have downloaded. The same command should be used as in Tip 45, with the **-ivh** and **--force** options present.

>_048 Fedora: distro upgrade

Yum has its own distribution upgrade command, but only in Fedora and they prefer you not to use it unless you have to. Nonetheless, you can use the fedora-upgrade package in yum with:

```
$ sudo yum install fedora-upgrade
```

"You can force a package to install even without the dependencies"

SEARCHING WITH GREP

>_Search within files using the grep command to save time and find what you need

>_049 Search a file for a term

The basic use of **grep** is to search through a file for a specific term. It will print out every line with that term in, so it's best to use it with system files with readable content in. Use it with:

```
$ grep hello file
```

>_050 Check for lines

Looking for specific lines in a file is all well and good, but when you then start to hunt them down and you realise the file is hundreds of lines long, you can save yourself a lot of time by getting **grep** to also print out the line number. You can do this with the **-n** option:

```
$ grep -n hello file
```

>_051 Regular expressions

If you need to make a more advanced search with **grep**, you can use regular expressions. You can replace the search term with **^hello** to look for lines that start with hello, or **hello$** for lines ending in hello.

>_052 Wildcards and grep

When searching for lines, you can use a wildcard if you need to look for similar terms. This is done by using a full stop in the search string – each full stop represents one wildcard character. Searching for **h...o** will return any five-letter string with h at the start of the string and o at the end. Use it like so:

```
$ grep '\<h...o\>' file
```

>_053 More wildcards

You'll also be using wildcards to find something ending or beginning with a specific string but with no fixed length. You can do this in **grep** by using an asterisk (*****) along with the dot. In the above example, we would have used **h.*o** instead.

DEVELOPMENT TIPS

>_Some terminal tricks for devs to help your command line skills become more efficient

>_054 Stop a system service

A system service is the kind of background software that launches at start up. These are controlled by the system management daemons like init or systemd, and can be controlled from the terminal with the **service** command. First, you can stop a service using:

```
$ sudo service name stop
```

>_055 Start a service

You can start system services that have been stopped by using the same **service** command with a different operator. As long as you know the service name, start it using:

```
$ sudo service name start
```

>_056 Restart a system service

This one is popular with setting up web servers that use Apache, for which restarts may be needed, along with other services that you customise along the way. Instead of running both the **stop** and **start** commands sequentially, you can instead restart services by using:

```
$ sudo service name restart
```

>_057 Know the ID

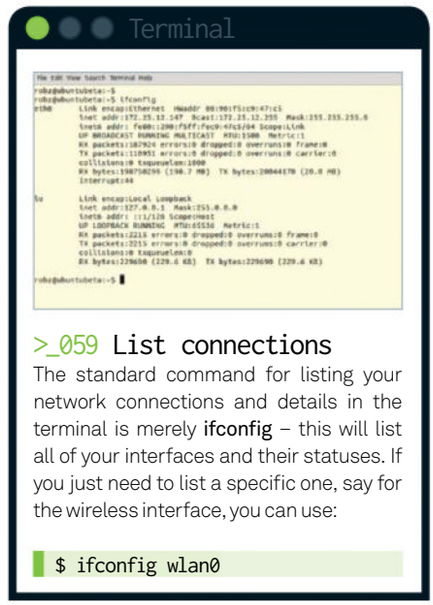
The ID that you can get for the software with **top** can be used to manipulate it, but a common reason to know the ID is so that you can end the process if it's having trouble stopping itself or using too many resources. With the ID in hand, you can kill it with:

```
$ kill 1234
```

>_058 Kill multiple IDs

Sometimes a process can be split up over multiple IDs (this is usually the case with a web browser – Google Chrome is a notorious example), and you need to kill multiple processes at once. You can either try and quickly kill all the IDs, or use the common name for the process and kill it with:

```
$ killall -v process
```



>_059 List connections

The standard command for listing your network connections and details in the terminal is merely **ifconfig** – this will list all of your interfaces and their statuses. If you just need to list a specific one, say for the wireless interface, you can use:

```
$ ifconfig wlan0
```

>_060 List USB devices

You may need to know which USB and USB-related devices are connected to a system, or find our their proper designation. You'll need to install it first, but once you have, you can use **lsusb** in the terminal to list all of the available devices.

>_061 List hard drives and partitions

Whether you need to check the designation of certain drives for working on them, or you just need to get a general understanding of the system's layout, you can use **fdisk** to list all the hard drives. Do this in the terminal with:

```
$ sudo   -l
```

>_062 Check running software

Sometimes you'll want to check what's running on your system and from the terminal this can be done simply with **top**. It lists all the relevant information you'll need on your currently running software, such as CPU and memory usage, along with the ID so you can control it.

>_063 Unpack a ZIP file
If you've downloaded a ZIP file and you did it from the terminal or you're working from it, you can to unpack it using the **unzip** command. Use it like so:

```
$ unzip file.zip
```

>_064 Unpack a TAR file
Sometimes Linux will have a compressed file that is archived as a .tar.gz, or a tarball. You can use the terminal to unpack these or similar TAR files using the **tar** command, although you need the right options. For the common .gz, it's:

```
$ tar -zxvf file.tar.gz
```

>_065 Copy and write disks
Coming from UNIX is a powerful image tool called **dd**, which we've been using a lot recently for writing Raspberry Pi SD cards. Use it to create images from discs and hard drives, and for writing them back. The **if** is the input file or drive and the **of** is the output file of the same. It works like so:

```
$ dd if=image.img of=/dev/sda bs=1M
```

>_066 Create an empty file
Sometimes when coding or installing new software, you need a file to write to. You could create it manually with **nano** and then save it, but the terminal has a command similar to **mkdir** that enables you to create an empty file – this is **touch**:

```
$ touch file
```

>_067 Print into the terminal
The terminal uses **echo** to print details from files into the terminal, much like the C language. If you're writing a Bash script and want to see the output of the current section, you can use **echo** to print out the relevant info straight into the terminal output.

>_068 Check an MD5 hash
When downloading certain files it can help a lot to check to make sure it's downloaded properly. A lot of sites will offer the ability to check the integrity of the downloaded file by comparing a hash sum based on it. With that MD5 and the file location at hand, you can compare it with:

```
$ md5sum file
```

>_069 Run commands to x
Sometimes you need to do something concerning the x display, but the only way you can enter the command line is by switching to an alternate instance with **Ctrl+Alt+F2** or similar. To send a command to the main x display, preface it with **DISPLAY=":0"** so it knows where to go.

>_070 Create a new SSH key
When you need to generate a strong encryption key, you can always have a go at creating it in the terminal. You can do this using your email address as identification by entering the following into the terminal:

```
$ ssh-keygen -t rsa -C
"your_email@example.com"
```

>_071 System details
Sometimes you want to check what you're running and you can do this with the simple **uname** command, which you can use in the terminal with the following:

```
$ uname
```

>_072 Kernel version
As part of **uname**, you also get the kernel version. Knowing this can be useful for downloading the right header files when compiling modules or updating certain aspects. You can get purely the kernel version by adding the **-r** option:

```
$ uname -r
```

>_073 CPU architecture
If you're on an unknown machine, you might need to find out what kind of architecture you're running. Find out what the processor is with:

```
$ uname -p
```

>_074 Everything else
Uname enables you to display a lot of data that is available from the system and you can look at all of this information by simply using the **-a** option with the command:

```
$ uname -a
```

>_075 Ubuntu version
With all the distro updates you do, it can be tricky to keep track of which version of Ubuntu you are on. You can check by using:

```
$ lsb-release -a
```

"To send a command to the main x display, preface it with DISPLAY=":0""

FILE PERMISSIONS

>_Learn how you can view file permissions and get to grips with how they should be properly modified

>_076 List file permissions
You can check the file permissions of every item, including hidden files and directories, in the terminal using **ls -la**. It will print out the file permissions as a ten-character string in the first column of output. The first character identifies the file type, with **d** indicating a directory and **-** indicating a regular file. We're interested in the last nine characters, which are actually three sets of three and are interpreted differently. For example:

```
rwxr-xr-x
```

R stands for read, **w** stands for write and **x** stands for execute. If they're present instead of a **-**, it means that it is present in that particular block of permissions. It's split up over three blocks: the first three being the user you are currently using, the second being the group and the third being for everyone else.

>_077 Change permissions
With the permissions ascertained, you can start editing them if you want via the **chmod** command. You edit each of the three permissions set by assigning it a number that treats the three-bit permissions set as a binary. So you'd do something like:

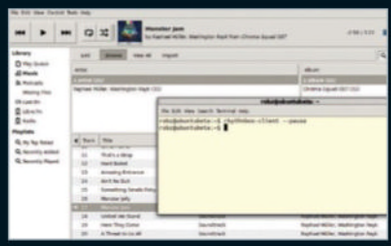
```
$ chmod 777 file
```

The first number is for the user permissions, the second is for the group and the third is for everyone else. The numbers mean:

```
7: read, write and execute, 111/rwx
6: read and write, 110/rw-
5: read and execute, 101/r-x
4: read only, 100/r--
3: write and execute, 011/-wx
2: write only, 010/-w-
1: execute only, 001/--x
0: none, 000/---
```

MEDIA CONTROLS

>_You can control your tunes while working inside the terminal



>_078 Pause music

Some audio players have command line controls they can use. Rhythmbox has this and it's a cool thing to use when you're stuck in the terminal and need to just pause your music for a moment. You can do this by using:

```
$ rhythmbox-client --pause
```

>_079 Skip music

The command line controls don't enable as much as you can get in the interface, however you can at least skip to the next track. Try it with the command below:

```
$ rhythmbox-client --next
```

>_080 Pause video

You can use Mplayer to launch video from the command line to watch. It's good for testing a video with different settings that you can affix to the video-playing command. What you can also do is control the playing video with keys – specifically, you can pause by using the space bar.

>_081 More video control

Mplayer gives you a few more controls while playing in the command line. You can use Enter to skip to the next item in a list, and otherwise, you can stop playback by using **Ctrl+C** to end the process entirely.

BEST OF THE REST

>_All the other commands that you might want to know for future reference

>_082 Open files in terminal

If you've got a file you can see in a graphical file manager, instead of opening a terminal and navigating to and then executing the file or script, you can usually run it directly from the terminal. To do this you usually just need to right-click and select a 'run in terminal' option.

>_083 Find files in terminal

You can search for specific files throughout the filesystem by using the **find** command. You need to give find a location to search in and a parameter to search for. For simply searching for a file from root with a specific name you can use:

```
$ find / -name file
```

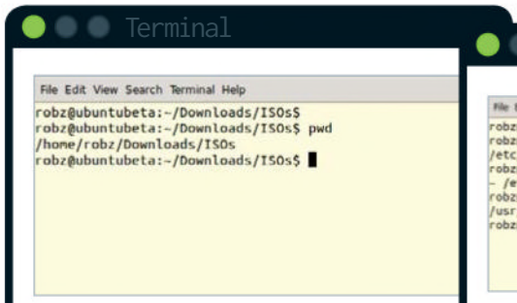
>_084 Locate files in terminal

Similar to find is **locate**, a newer tool that works slightly differently to find. While find also has ways to search for files by age, size, owner and so on, locate only really uses the name to locate, however it can do it so much faster. Use it with:

```
$ locate file
```

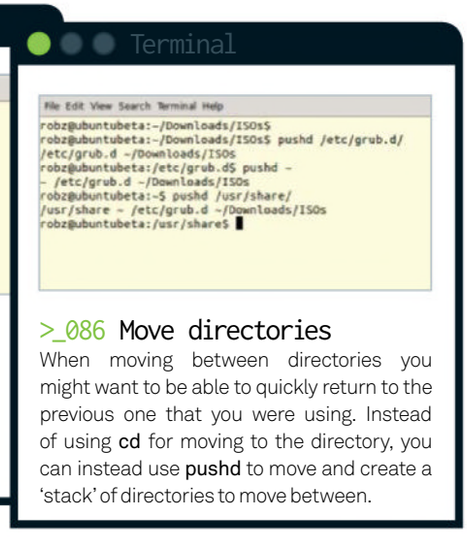
>_085 Current location

In the terminal you might find yourself a little lost in the filesystem, or want a quick and easy way to pipe your current location into something else. You can print out your current absolute location using **pwd**.



>_086 Move directories

When moving between directories you might want to be able to quickly return to the previous one that you were using. Instead of using **cd** for moving to the directory, you can instead use **pushd** to move and create a 'stack' of directories to move between.



>_087 Move back through pushd

Following on from Tip 86, once you want to start moving back up the stack to the first directory, you can use **popd** in the terminal. You can also check which directories you have stacked up by using the **dirs** command as well.

>_088 Process priorities

CPU priority for processes can be seen as running from -20 for highest priority or +20 for lowest. Putting **"nice -n X"** in front of any command enables you to change the priority from 0 to whatever number X is standing in for. Only **sudo** or root can elevate the priority of a process, but anyone can set one down the priority chain.

>_089 Download via the terminal

If you need to download something via the Internet in the terminal, you'll want to use the **wget** command. It will take any URL you specify and download it directly into your current location in the terminal (as long as you have permission to do so). Use it like:

```
$ wget http://example.com/file.zip
```

>_090 Change image formats

Instead of loading up an image editor like GIMP, you can actually change images in the terminal using the **convert** command. You can very simply use it to change the filetype or even change the size. Do it with:

```
$ convert image.jpg image.png
```

>_091 Alter image settings

As well as **convert** there's also **mogrify**, which is part of the same software package. You can use it scale, rotate and do more to an image more easily than with some of the **convert** commands. To resize you can use something like:

```
$ mogrify -resize 640x480! image.png
```

>_092 Send message to displays

This is an old school prank that can actually have good uses when done right. **Xmessage** enables you to send a message prompt to an x display on the same system, as long as you know the display you want to send it to. Try:

```
$ DISPLAY=:0 xmessage -center "Hello
World!"
```

>_093 Rename files with cp

This is an extension of the way you can use **cp** – **cp** will copy a file and name it to whatever you want, so you can either copy it to another directory and give it a different name, or you can just copy it into the same folder with a different name and delete the original. This also works for renaming with **mv**.

>_094 Manual screenshots

This is something we have to do during Raspberry Pi tutorials, but it works everywhere else. For GNOME-based desktops you can do it in the terminal by calling **gnome-screenshot**, in XFCE it's **xfce-screenshooter**, in LXDE it's **scrot** and so on. This will immediately take a screenshot of what you can see.

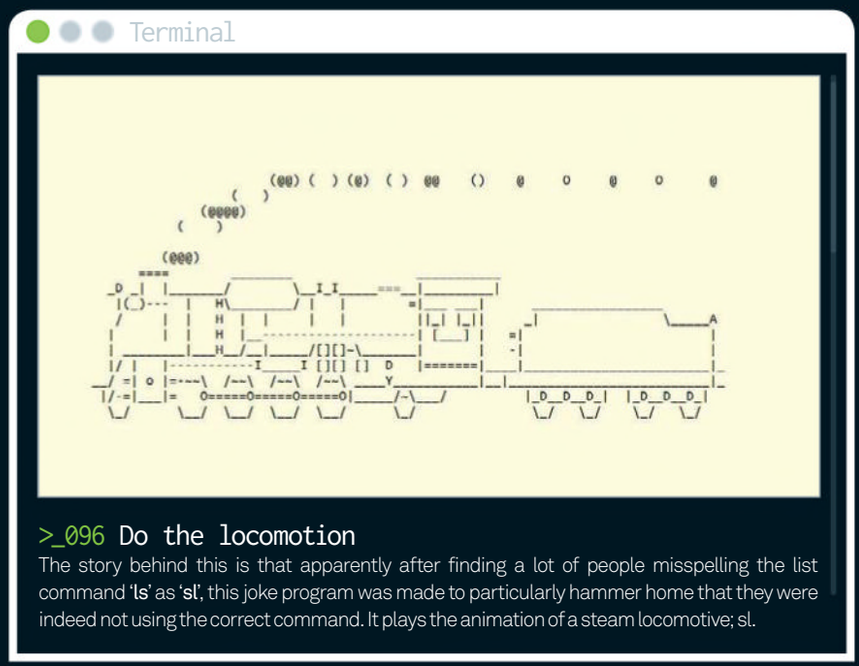
>_095 Delayed screenshots

With the functions above, you can add delay to set up a screenshot. This is useful if you want to show the contents of a drop-down menu, for example. Screenshot tools allow you to delay by adding the **-d** option and number of seconds, eg:

```
$ scrot -d 5
```

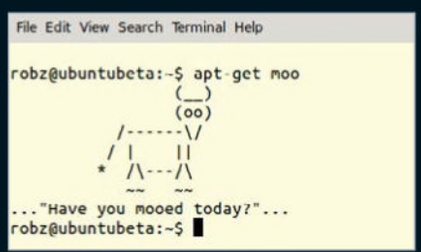
TERMINAL JOKES

>_Easter eggs, gags and other attempts by patterless software engineers to be funny



>_096 Do the locomotion

The story behind this is that apparently after finding a lot of people misspelling the list command '**ls**' as '**sl**', this joke program was made to particularly hammer home that they were indeed not using the correct command. It plays the animation of a steam locomotive; sl.



>_097 What does the cow say

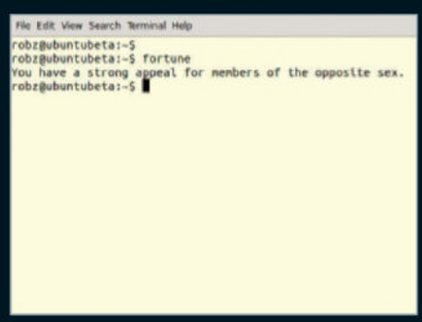
A Debian trick as part of apt-get, **moo** is an easter egg wherein you type **apt-get moo** and a cow asks you if you have mooed today. If you have, in fact, not mooed today then you should immediately find a quiet room and let out a single, loud moo to appease the terminal cow.

>_098 Let it snow

This one uses a Bash script to simulate snow in the terminal. We have added the file you will need to use to **FileSilo.co.uk**, so download it, **cd** to the location of the file and then run it. It's completely pointless, especially in the middle of summer, but it can be relaxing.

>_099 What's in a date

You can actually write **date** into the terminal and it will print out the actual date according to its own internal clock for you, which is very useful. What you can also do is use **ddate** to create a 'discordian date' that prints out an almost dystopian date system.



>_100 Crystal terminal

Our last tip is **fortune**. Call it to get a hint at what your day might involve. Hopefully it's something inspirational to get you started. Remember though, it's just a random output from a string of code. Enjoy!

TIPS

Simple fixes to improve Linux systems

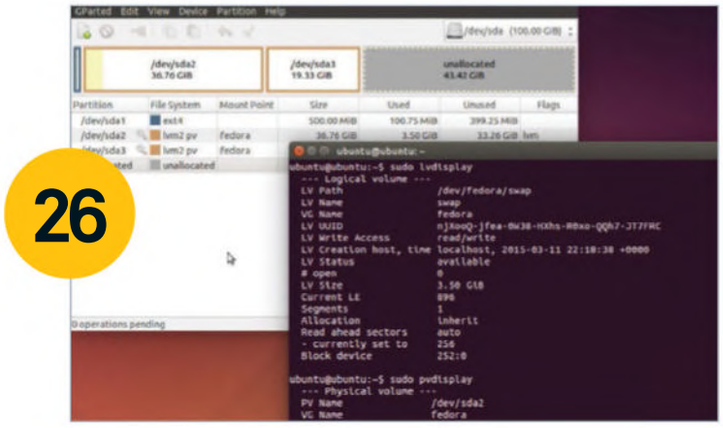
18 **Faster better servers**
Up your power with a self-built server

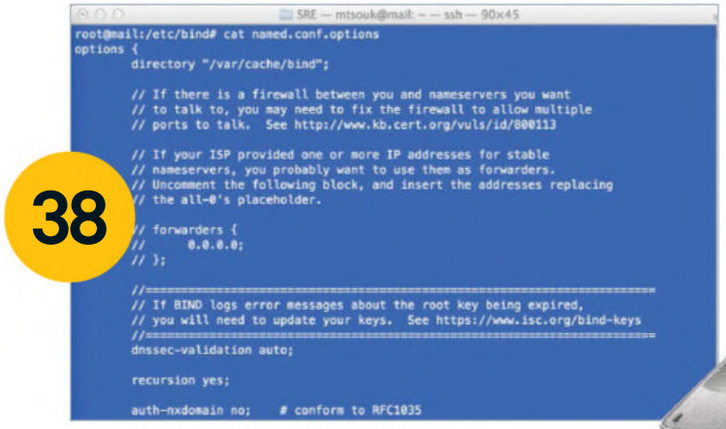
26 **Set up LVM filesystems**
Find an alternative to normal ext partitions

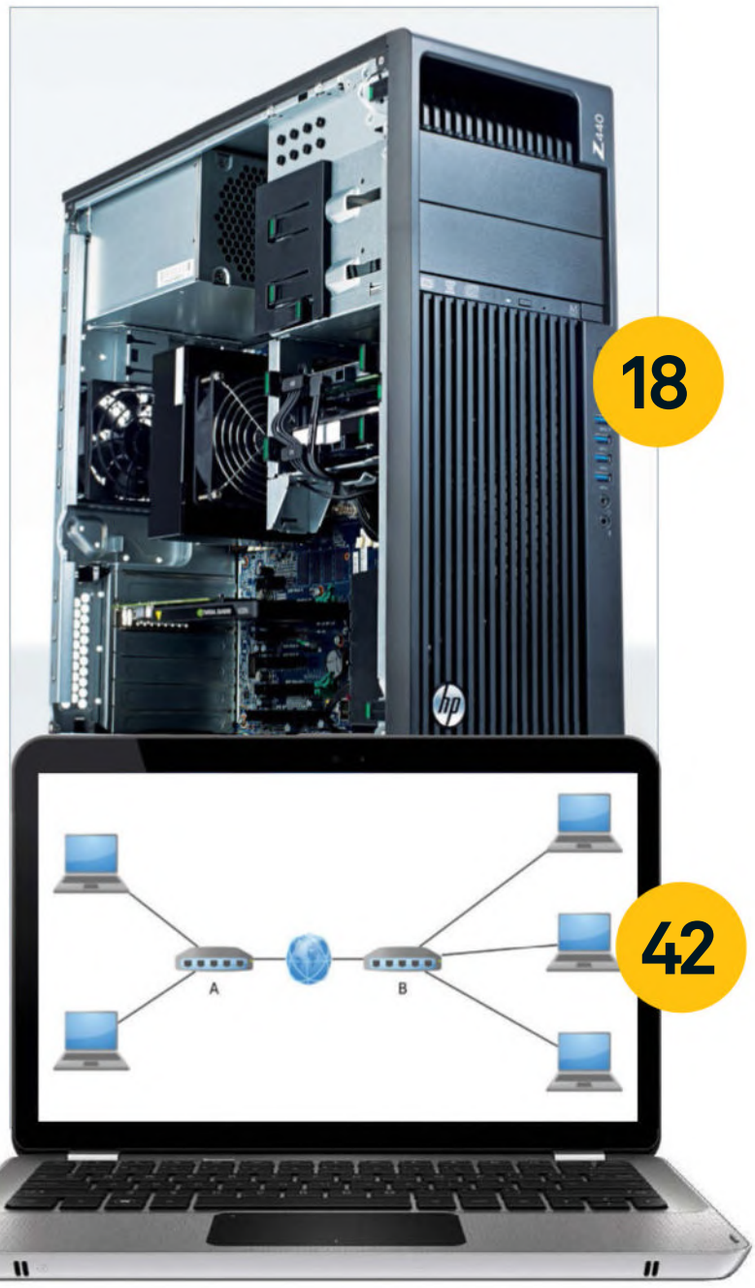
30 **Command-line control your email**
Use Mutt to take control of your inbox

34 **Run your own chat channel**
Let Scrollback help you communicate

38 **Create a caching DNS server with BIND**
Reduce network traffic and boost speed

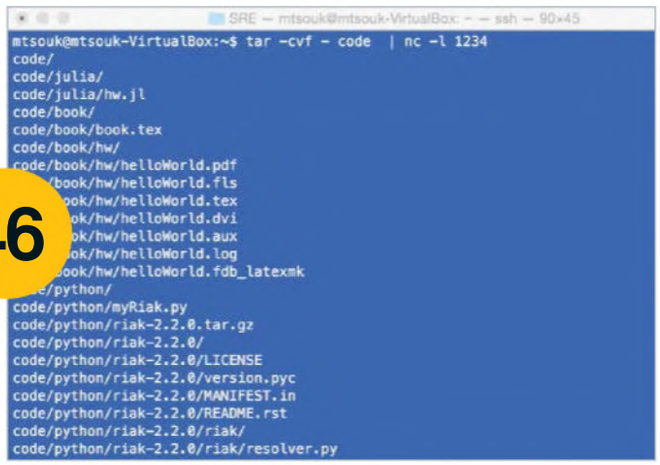






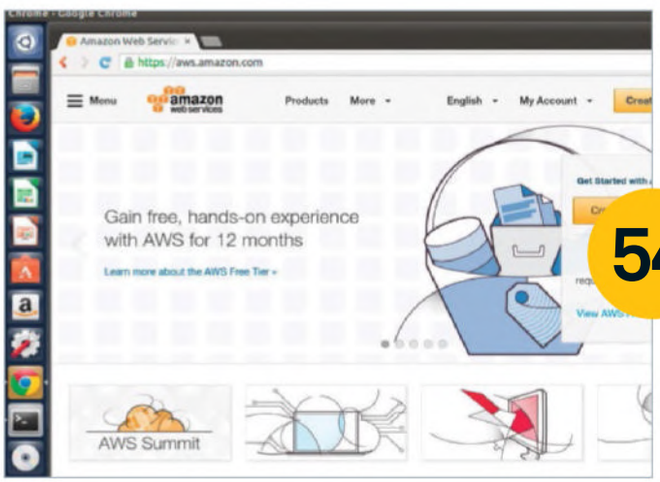


74



46

"There are many parts of a server to keep in mind, but it boils down to appropriate hardware and a good distro for the task at hand"



54

42 **Program a client-server application**
A simple solution to create chatty apps

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Use Netcat to accomplish several tasks

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Set up the features of this next-gen system

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Configure and run a virtual Linux instance

FASTER BETTER SERVERS

UP YOUR COMPUTING POWER WITH AN UPGRADED OR BRAND NEW SERVER THAT YOU CAN BUILD YOURSELF



While big business and big data may be utilising mainframes more of late, the concept of servers is not going away any time soon. Servers are an integral part of any system, however large your IT infrastructure is. Whether it's inside the data centre or tucked away in your (well-ventilated!) cupboard at home, there are still a lot of uses for servers in 2015.

For the office you may want to save a bit of money and create something perfect for your needs that you know exactly how to maintain. For home you may just want to enhance your setup and make the entire network more efficient. For both it's a great way to separate certain aspects of your network to control it in a more efficient way.

There are many components of a server that you need to keep in mind, but it boils down to an appropriate hardware selection and a good distro for the task at hand. In this tutorial, we are going to concentrate on file and web servers, two base server systems that can be expanded and modified in multiple ways to best fit the situation you are in.

As we're teaching you how to build a better web server, we will first take a quick detour to tell you what you should know if you want to upgrade your current server so that it can compete with the new tech.

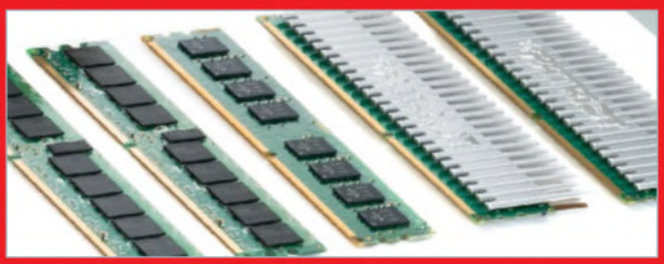


UPGRADING TO A BETTER SERVER

If you have a server, an upgrade may be all it needs to run better

You may already have a server, in which case instead of actually building a better server from scratch, you may want to just upgrade your server to be more efficiently than it was before. There are several ways of doing this depending on how you want to improve your server, and most of them require a hardware upgrade. If you decide to go down the hardware upgrade route, refer overleaf to see the kind of hardware that we recommend and learn some quick tips on how to install it if you're new to system building.

The easiest upgrade is storage space, especially for file servers. For Linux systems you can quite simply just add an extra hard drive into the case, as long as you have room in terms of spare SATA cables and power. Once installed, reboot your system and you can start adding the hard drive under /etc/fstab so that it automatically mounts to a specific location – in this case, the location on the filesystem which needs a bit more storage. Otherwise, you can create a clone of the system using Clonezilla (**clonezilla.org**) and then restore it to a larger hard drive with almost no change in the way it works.



Above RAM is much more important in a server than a desktop PC, as you need to serve several people

For other system hardware, you need to ask yourself which section is slow and perhaps needs upgrading. If it's a little slow for certain operations and computational tasks, your first port of call should be upgrading the CPU. Depending on how forward-thinking you were when building or buying the original system, the motherboard may support newer processors than the one inside it. Find out the socket information and start a search for a new CPU. While you'll need enough RAM to support the CPU and whatever the server is being used for, you'll always need more for one handling web services than file serving. You can easily replace these kind of parts without having to reinstall Linux.

If you're doing heavy computational tasks and can use hardware acceleration for it, look at getting a new video card to support it – although not many servers will even require one, let alone a good one.

If you've reached the limit of your current motherboard, it's time to gut the system and get a new mobo, CPU, RAM and GPU if you need it – backing up important files and settings is a good idea before you attempt this as Linux may not be able to work with completely new hardware without a reinstall.

Otherwise, if you need a software upgrade then refer to whatever guide is relevant to you in this feature on how to install and setup a new distro.

CHOOSING HARDWARE

What kind of hardware will you require to build a better server?

The hardware in a server is a very important consideration for building your system. Servers handle different requests to a normal desktop machine, often handling several people's requests at once. This means that the resource priorities have changed and these can even be different between various types of servers.

Software counts as well, of course, but without a decent hardware base, it will be tricky to have the server work as intended. Scalability and peak loads need to be considered as a future-proofing method, so always try and make sure that you have a bit more power than you need. With all that said, let's start looking at the individual components.

There are six main components you need to put thought into, and the four most important ones are the motherboard, the processor, RAM and power supply – the core components on any computer. As we mentioned, you need to think differently about what you need components-wise because resource usage is different.

A minor concern for some will be a graphics card of some kind, whether it's so you can directly interface with the system or do computational work that benefits from multiple different cores instead. You'll also need a good storage solution for your server build.

Motherboard

Motherboards for servers come in various styles. A lot of server boards will have two ports to connect a CPU to, which is good for servers used for small businesses or if you expect to get a lot of requests on a regular basis. These are more expensive than single-CPU systems, but the benefits in the long run for a big office server are more than worth it.

For home use, a single slot for a processor will do you fine for most cases, the main exception being a web server where you plan to have a lot of regular connections made to it. In this case, you want to keep an eye out for motherboards with plenty of storage and connection slots to make it as flexible and scalable as possible.



Above You won't need a GPU if your mobo has onboard graphics and you don't need multi-core processing

CPU

The most important thing for a server CPU is the number of cores – that's why dual-slots can be quite useful. More cores allows for more threads, essential if you plan to run VMs off a file server or several sites at the same time. Clock speed is not as important, but you should at least get one that is not ridiculously slow and comes with a decent cache.

With Intel's Hyper Threading, each core can work harder by creating multiple threads in each core. Conversely, AMD processors will offer more cores for a lower price, especially if you're on a budget.

RAM

A larger amount of RAM is more important on servers than it is on a desktop PC, enabling you to run more operations at once. Speed and latency is not so important, so gaming RAM with tweaked timings will not grant you a better system – in fact, it may be slightly worse since they don't have ECC. ECC fixes single-byte errors that make up the most common forms of data corruption in the RAM.

While ECC RAM can be important, it's more important in web servers and generally much more necessary in business and enterprise servers. On every level though, a larger amount of RAM is good.

PSU

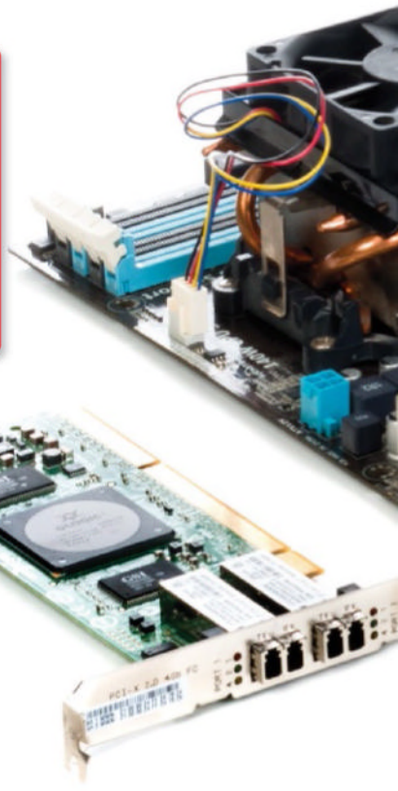
While it's best practice to never skimp on a power supply, it's near essential when it comes to server power. While you may need 1,000+ watts for your ridiculous 4K gaming rig (electricity bills be damned), you can be a little more reserved in the peak power for a home server, depending on its intended use. Look for power supplies with an '80 Plus' rating, as these ones have been through some level of certification to ensure that they have a degree of efficiency – this is a good idea for servers that are on all the time as they will save on electricity bills in the long run. Titanium and Platinum are the highest ratings, meaning they're at least 90 per cent efficient (95 per cent efficient for server power supplies).

MOTHERBOARD

When we talk about slots and connections for a motherboard, we're talking about PCI slots and plenty of SATA drive slots. You can add more SATA slots via a card, but you'll need to take into account anything else you'd want to add a card for. You need to make sure the motherboard's chipset matches up with the kind of CPU you want as well, and the CPU will also dictate the type of RAM you get. It's a multi-layered balancing act that may result in a sea of tabs while you compare and contrast

FIBRE CARD

Networking cards can be essential if your server is also acting like a more traditional network server, handling all your network data and even being used as a modem and firewall. There are plenty of different PCI cards for these kinds of tasks, including this fibre card for a bit more serious Internet use



Storage

Depending on your storage requirements, there are multiple solutions that you can use. At the very least we recommend you split up your storage with an SSD for the operating system and associated settings files, and use standard hard drives for storing everything else. This way, when the general files are not being accessed, the operating system can still run while drawing much less power.

Otherwise, your actual mass storage can be configured in multiple ways. You can have straight drives connected with JBOD for minimal complexity. Or you can start looking down the RAID route – mirroring in case of drive failure, striping to more efficiently use the space of two hard drives, or even going as far as RAID 5 and 6, which increases complexity but enables you to create one large, consistent storage space with redundancy failures. The more complex you go though, the more difficult it can be to maintain and the more catastrophic a major failure can be.

PSU

When picking a PSU you need to keep in mind a few things, such as what kind of connectors you need. This can depend on your motherboard, the amount of hard drives you're using, any extras like case fans and case I/O panels. If you want a better idea of what kind of wattage you will need, you can use this tool to figure it out: **bit.ly/1pjcjns**

CASE

For server cases, you need to think of where you're using your server. At home, a silent case can be great, with padding to keep the noise down while it runs all the time. In the office, and assuming it will be taxed a bit more, you'll need to take into consideration proper cooling. Size is also a factor, as you need to fit your parts in

RAM

You don't need RAM with heatsinks for server PCs, really – it's usually reserved for gaming RAM with tweaked timings. If you are concerned with the heat of your system and have a little more budget to spend, get RAM with some kind of heat dissipater

DVD DRIVE

They're more rarely needed these days, but it can sometimes be handy to have an optical drive for transferring data or to have ISOs installed to. If you're using your server to serve files and media, you can create redirects to be able to play DVD or Blu-ray movies, or even rip ones that don't come with any DRM at all

BUILD A FILE SERVER

Store and serve files around your network or further

File servers are very useful for both home and business environments. For home, it's a good way to have a more low-power, dedicated solution to storing your media and backing up your systems, without needing to specifically turn on your desktop machine to get the files – a desktop machine that may use more power idling than a dedicated file server.

For enterprise, it can not only be useful for backups, but also provides for off-machine networked storage for individual users that can be accessed from within and outside the network. So, let's set a server up.

For a simple server type such as this, we're going to go ahead and use Ubuntu Server to set up the system. This means that if you have any experience with Linux, it should be easy to maintain and install more software on if you need to.

If you're doing the initial setup for a home server then installing it with a monitor attached will be much easier. Burn the ISO to an installable medium or boot it over the network if you have the facilities set up, then hit return on 'Install Ubuntu Server' to continue.



Installation

The installation for the server edition is different from the usual graphical installer of Ubuntu – it's a command line one, albeit with fairly straightforward options. After setting up your location, language and keyboard settings, it will try and detect your hardware for you. Give your server a name, set up your username and password, and then continue with the installation as directed.



Above You'll need to configure Samba in order to get shared folders working

Like the graphical Ubuntu, the server edition comes with options to automatically set up the partitions – by default, using the whole disc will create an install partition and a swap. If you want it to use a specific set of partitions, we recommend sorting them out with GParted before trying to install, and then assigning the partitions manually yourself.

During installation you'll get some extra questions about whether you need a proxy or not; set that up as you wish and then it will ask about other services to install. As we're using this as a file server, make sure OpenSSH is installed so you can dial in from another machine on the network and ensure that a Samba server is installed, to make sharing files and such over the network easier and compatible with any Windows machines.

Finally, it will prompt you to install GRUB. Assuming this is a dedicated file server, you can let it overwrite the master boot record. Once that's done you will restart the system, so make sure you remove the live boot medium. After it loads up, you will be dumped into the command line to log in – as this is a server distro, there is no desktop environment.

First steps

Now you're into Ubuntu, we'll first get set up to SSH into the machine. For something like a home server it's best to set a static IP, and we can do that in /etc/network/interfaces. Open it up with:

```
$ sudo nano /etc/network/interfaces
```

... and change the primary network interface to be something like:

```
auto eth0
    iface eth0 inet static
        address [Desired IP]
        netmask 255.255.255.0
        gateway [Router address]
```

If you are using a wireless connection, make sure you switch it to wlan0 and then add in details for the SSID and password.

With the IP you've set, or using ifconfig to find out what the IP has been automatically set as, you can now SSH into your machine using the username and password that you set up. From a machine on the same network, type:

```
$ ssh [username]@[IP address of server]
```

Entering the password will grant you access to the same command line interface.

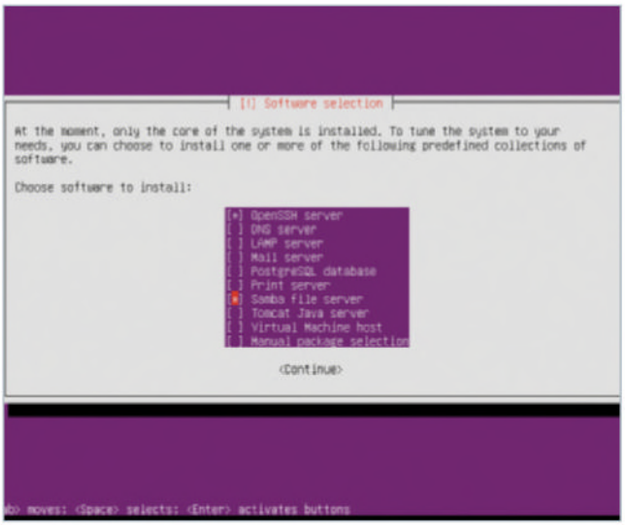
Shared folders

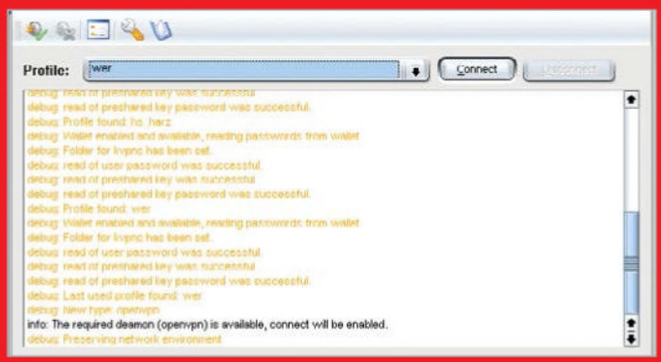
Now we can create a shared folder that the rest of the network can see and modify. First, let's create the folder that we want to use and put it in the normal home directory, with a usual:

```
$ mkdir ~/networkshare
```

EXTRA FILE SERVER USES

File servers can be useful for other things as well





Above left For a flexible, scalable server, consider trying MAAS: **maas.ubuntu.com/docs1.5**

Above right Ubuntu Server makes it easy to grab the software you need during installation

It's best if you don't use any spaces, to make the sharing simpler. Once done, you'll need to create a password for Samba. Do this by entering:

```
$ sudo smbpasswd -a [username]
```

It will ask you to enter and then confirm the password. Once that's done, and with the folder created, we can add it to the Samba server. Access the config file using:

```
$ sudo nano /etc/samba/smb.conf
```

Go to the very end of the file and add something like the following to get the shared folder recognised by Samba:

```
[NetworkShare]
path = /home/[username]/networkshare
available = yes
valid users = [username]
read only = no
browseable = yes
public = yes
writable = yes
```

Save the file and exit, then restart Samba:

```
$ sudo service smbd restart
```

And finish by testing the setup with **testparm** to ensure everything runs okay.

VPN

Dialling in externally from a remote location to VPN into your server can have added benefits. Accessing your files remotely is one thing, but also being able to use a more unrestricted Internet service (yours) can be handy if you're stuck in a hotel or other location with strict browsing regulations.

Setting it up is not too difficult and requires the server to be connected to the Internet wherever it stays. The more users you allow to VPN from it, the more resources you'll require (including RAM and processing power).



Torrent server

With all the storage and possibly a connection to the Internet, you can set up the file server to also be a torrent server. This will enable you to give back to the community by seeding the latest distro torrents, as well as making sure you have the latest version of certain distros for you to install and test with.

Just adding a torrent service will let you do this, and a good one for command lines is rTorrent. Not only can you view a useful command line interface with it, but you can also set a folder that it reads for new torrents.

BUILD A WEB SERVER

Host your web services on a dedicated server that you control

Your own web server can be a useful addition to any system. If you don't have massive loads to worry about you can install it to your own custom-built server, or if you have a lot of scalable server space then you can build it on there with a very similar software setup.

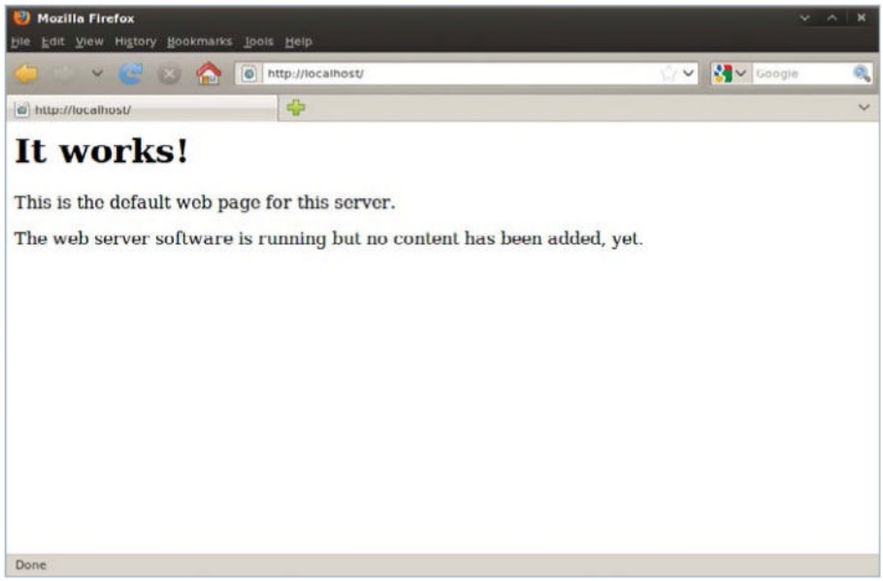
We are going to use Ubuntu Server again for this, so follow our advice on the previous pages on how to get it set up and get to a point where we can start adding Apache services. Feasibly, you could have the server be both a file and web server in this way.

01 Install Apache

Once you've got your server set up and can SSH in, it's time to install the Apache web server . Do that using the following:

```
$ sudo apt-get install apache2
```

It will automatically set the domain address to the following: 127.0.0.1



Above Give your web server a test once you've installed Apache

02 Test server

If you have to install a GUI onto your server, you can test out that Apache is working by going to a browser in it and navigating to 127.0.0.1. Otherwise, from an external system, navigate to the IP address of your system in your browser and it should show the Apache confirmation page on-screen.

"With a web server you can now use it to host your own website or to access storage from the server remotely over the Internet"







03 Install FTP

With a web server you can now use it to host a website or to access storage from the server remotely over the Internet. We can set up the latter using FTP, or in our case the secure VSFTP. Install it to the system using:

```
$ sudo apt-get install vsftpd
```

04 Configure FTP

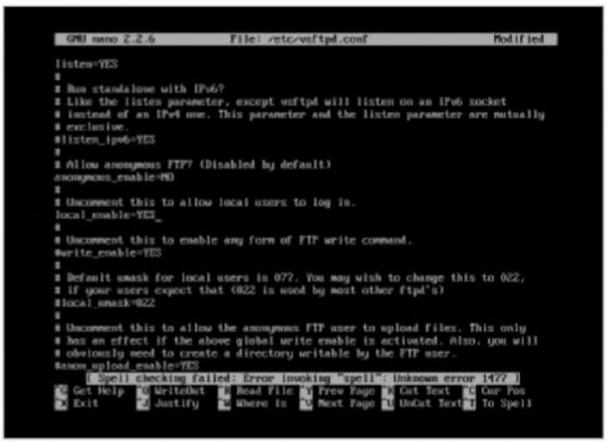
We can access the configuration file for FTP by using nano to open /etc/vsftpd.conf (**sudo nano /etc/vsftpd.conf**). From here we can configure it to match our uses, but first it is necessary that we increase the security just slightly before using it properly as an FTP server, just to be on the safe side.

05 Secure your FTP

The main change to make the FTP secure is to turn off anonymous users. In the config file, look for the line with 'anonymous_enable'. We want to change this to NO if it's not already there, just to make sure that there is a bit more security for the FTP server and that all of your content is kept private.

EXPAND YOUR WEB SERVER

Tailor your web server to suit all of your individual needs



06 **Local use**

While it will be great to access these files externally, we might as well have it so you can access the FTP internally too, just in case you prefer that to a shared folder. Find the line 'local_enable' and change it to YES to make sure it's accessible elsewhere.

07 **Edit files**

As we are only letting people we want onto the server, we can make it so anyone logged in has write access. To do this, go back into the config file, look for the line with 'write_enable' and change it to YES. You may also need to uncomment it by removing the hash.

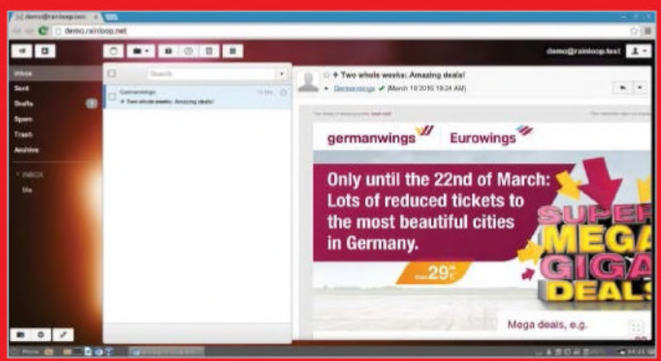
08 **FTP Folder**

If you didn't create a shared folder for the previous server tutorial, now is a good time to create a dedicated directory for this. In the home folder, use mkdir to create a directory called whatever you wish for the FTP server to be able to access it.



09 **Restart server**

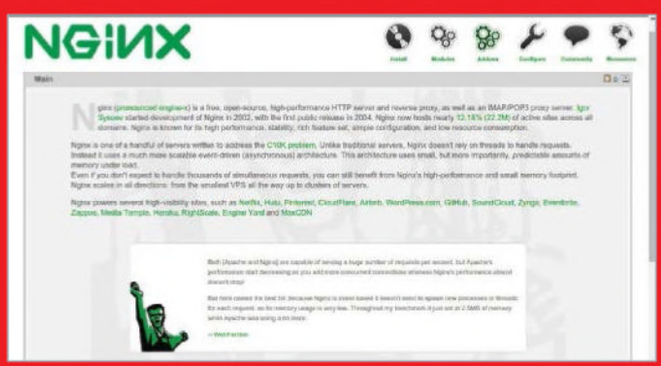
Once the config file has been fully edited and the folder is created, it is now time to start using it. Restart the FTP server using **sudo service vsftpd restart** and you will start to be able to access the folder. Any changes that you make to the configuration will require this restart to become active.



Mail server

Part of the benefits of this being a web server is that it enables you to also add your own mail server to it, or even host your own webmail client as well. Having Apache configured is the first step to this, and it is quite straightforward to then set up a mail server on top of that.

As for a webmail client, we recommend using RainLoop, which looks nice and modern and also lets you add other webmail services to it, along with your own webmail server.



Nginx server

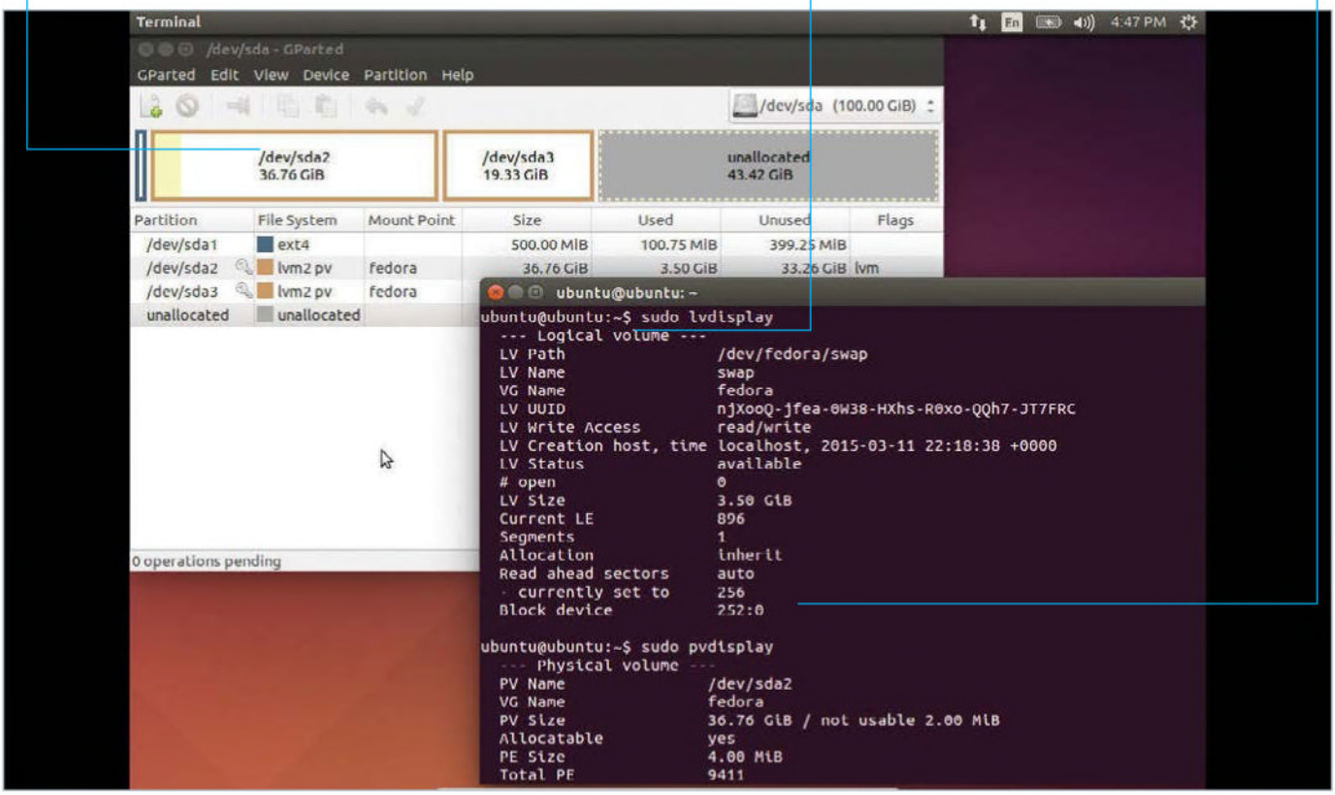
Instead of using Apache for the server, you can also look into and try out Nginx. Nginx handles processes slightly differently than Apache and can result in a lighter load on your web server. It's available in the repos of most distros, much like Apache is, so it can be installed in mostly the same way.

For a more complete guide to setting up an Nginx server, you can always refer back to one of our tutorials from Mihalis – it's inside issue 144, if you have it to hand, and on our website: **bit.ly/1AYKkx8**.

Understand the limitations of graphical partitioning when dealing with LVM filesystems

Create, name and modify logical volumes and volume groups that contain all your data

Add more hard drives and partitions to the LVM to keep expanding the space forever by allocating it smartly



Set up LVM filesystems

Quite a different filesystem to your normal ext partitions, but LVM might just be the way for you to go

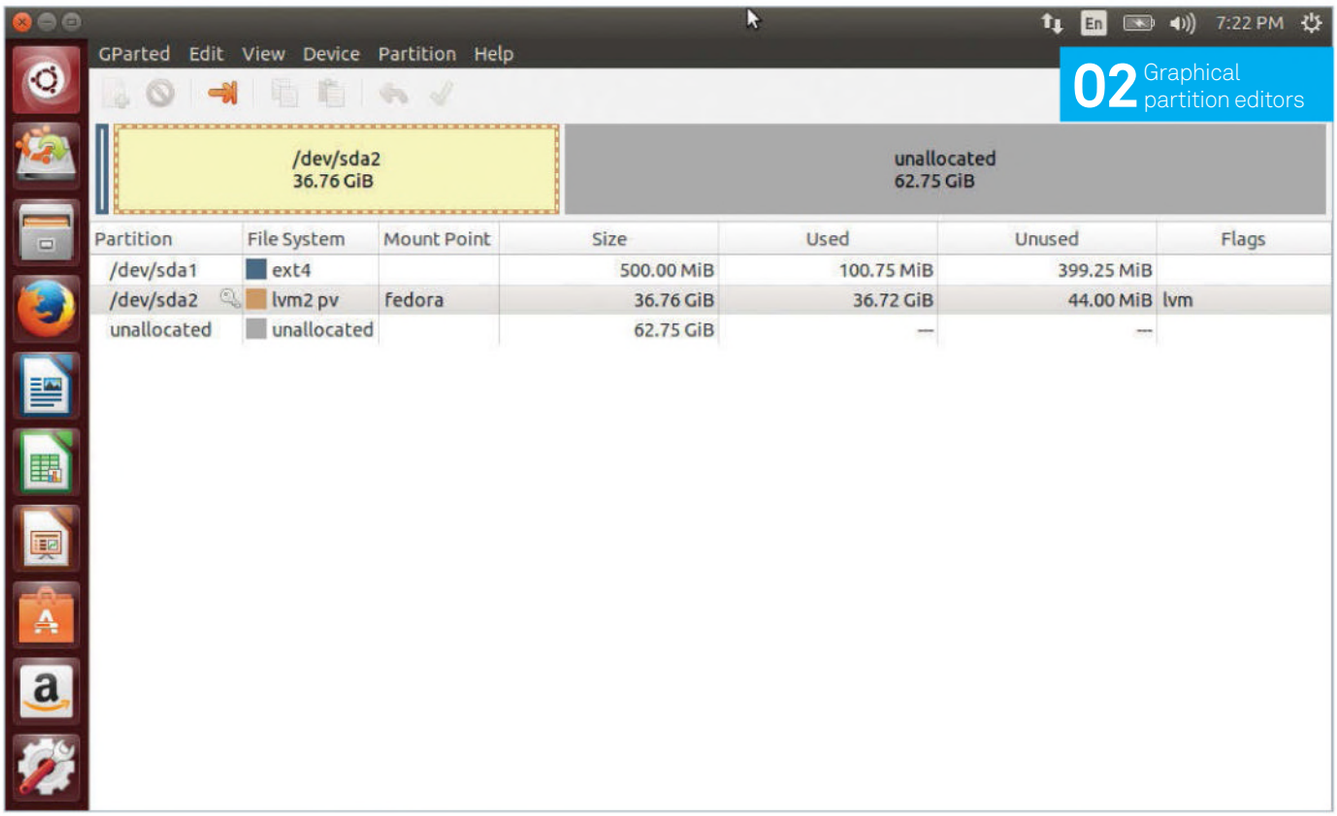
You'd be forgiven for not knowing what LVM stands for, but it's a useful thing to know. Logical volume management, as it's properly designated, acts as a sort of container to manage your data – the benefit of this is that you can start adding and extending space while the LVM is still online and working. This is great for server farms because you can swap out and add storage very quickly, and on your desktop its particularly good for managing the size of different partitions if you weren't sure how they should have been during installation.

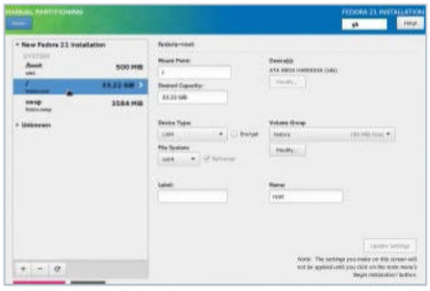
In this tutorial, we'll look at how you can create an LVM filesystem and then how you can go about maintaining and modifying it. We will also look into how some distros install using LVM.

Resources

LVM 2 tools sourceware.org/lvm2

gparted gparted.org





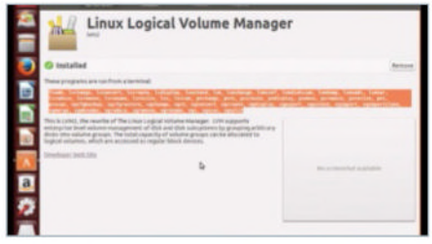
01 Install LVM

Many distros have the option to install using an LVM filesystem. In our example, we've left the LVM option checked when installing Fedora 21. This will automatically create a boot and storage partition within the logical volumes for you to play about with later.

02 Graphical partition editors

General partition editors like gparted have a bit of a tough time working with LVM filesystems – with the right tools installed you can see the partition but you can't really do much to it. For this tutorial, we will be working mostly within the terminal.

"You can swap out and add storage very quickly, and on your desktop its particularly good for managing the size of different partitions"



03 Use LVM tools

Although you can edit partitions live, we suggest booting into a live disc or other distro on the system instead. Once you have, install the LVM2 tools if they haven't been installed already. The package is called lvm2 in the repos and contains various tools for looking at and manipulating LVM partitions, which is useful.

04 View the LV

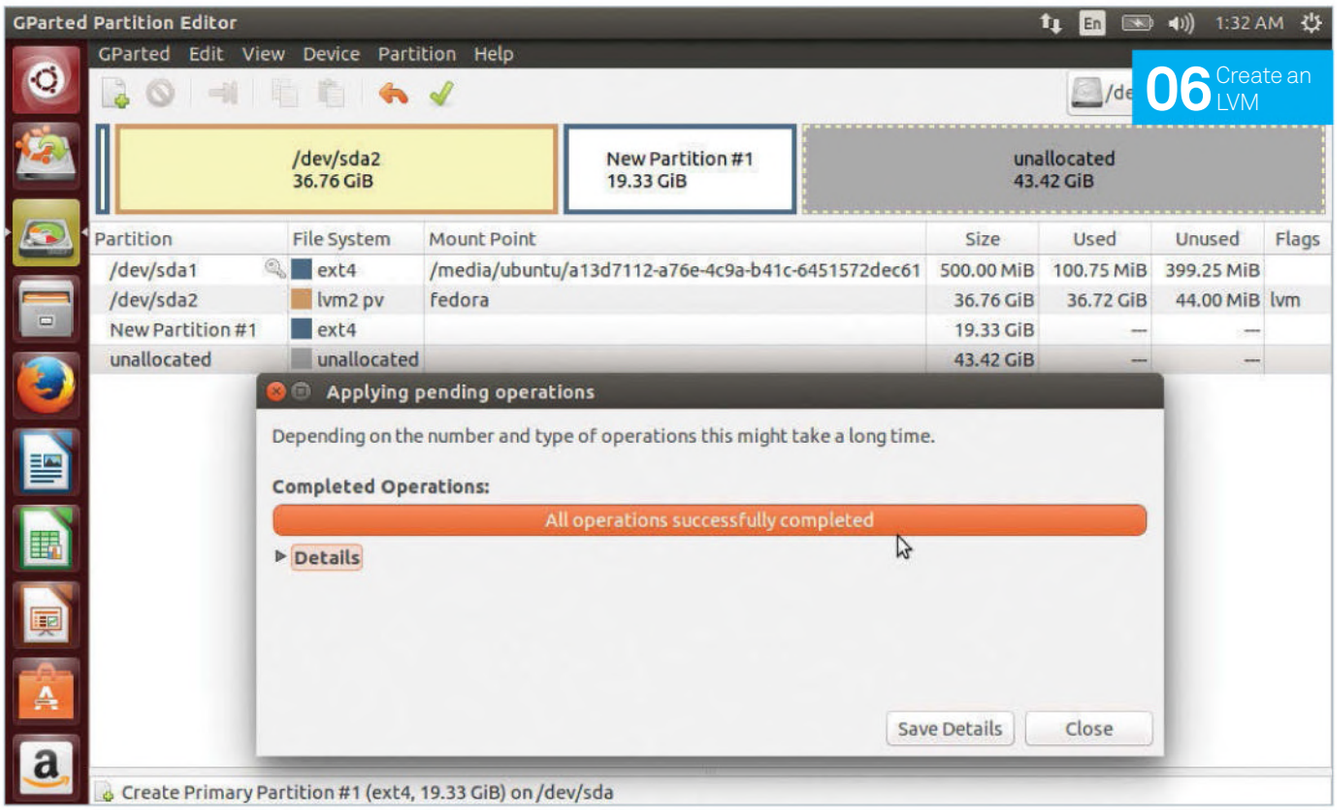
Now the tools are installed, we can have a peak at the LVs (logical volumes) on the system. This will display the volume group, the name type and size. Open up the terminal and use:

```
$ sudo lvdisplay
```

05 See the volume group

The LVM partitions are kept inside a volume group, which in our case is called Fedora but could be called anything. You can get more accurate details on this by using the volume group tools like so:

```
$ sudo vgdisplay
```



"Make sure you know the designation of the partition"

06 Create an LVM

It takes multiple steps to make an LVM filesystem. You need to create a physical volume for the volume group to be in and then you can create your logical volume inside that. First though, create a new partition on the system in your preferred method.

07 Make a physical volume

Once the partition is made, you can turn it into a physical volume. Make sure you know the designation of the partition (in our case /dev/sda3), which you can find out with **fdisk -l**. Create the PV with:

```
$ sudo pvscreate /dev/sda3
```

08 Include a volume group

Now with a physical volume to play with, we need to create a volume group with a name. Make sure you still remember the partition designation and create it with something like:

```
$ sudo vgcreate LUDVG /dev/sda3
```

You can add several partitions and/or hard drives like this as well.

09 Create a logical volume

The final step is to include a logical volume. Give it a name, tell it how much space to use and which volume group it should belong in. To fill up a 20 GB volume group, use:

```
$ sudo lvcreate --name root --size 20G LUDVG
```

10 Extend the volume group

If you want to extend the space in your original volume group, first create a new physical volume as before. Find out the name of the volume group (**vgdisplay**) and use the designation of the partition to extend with:

```
$ sudo vgextend /dev/fedora /dev/sda3
```

11 Alter the logical volume

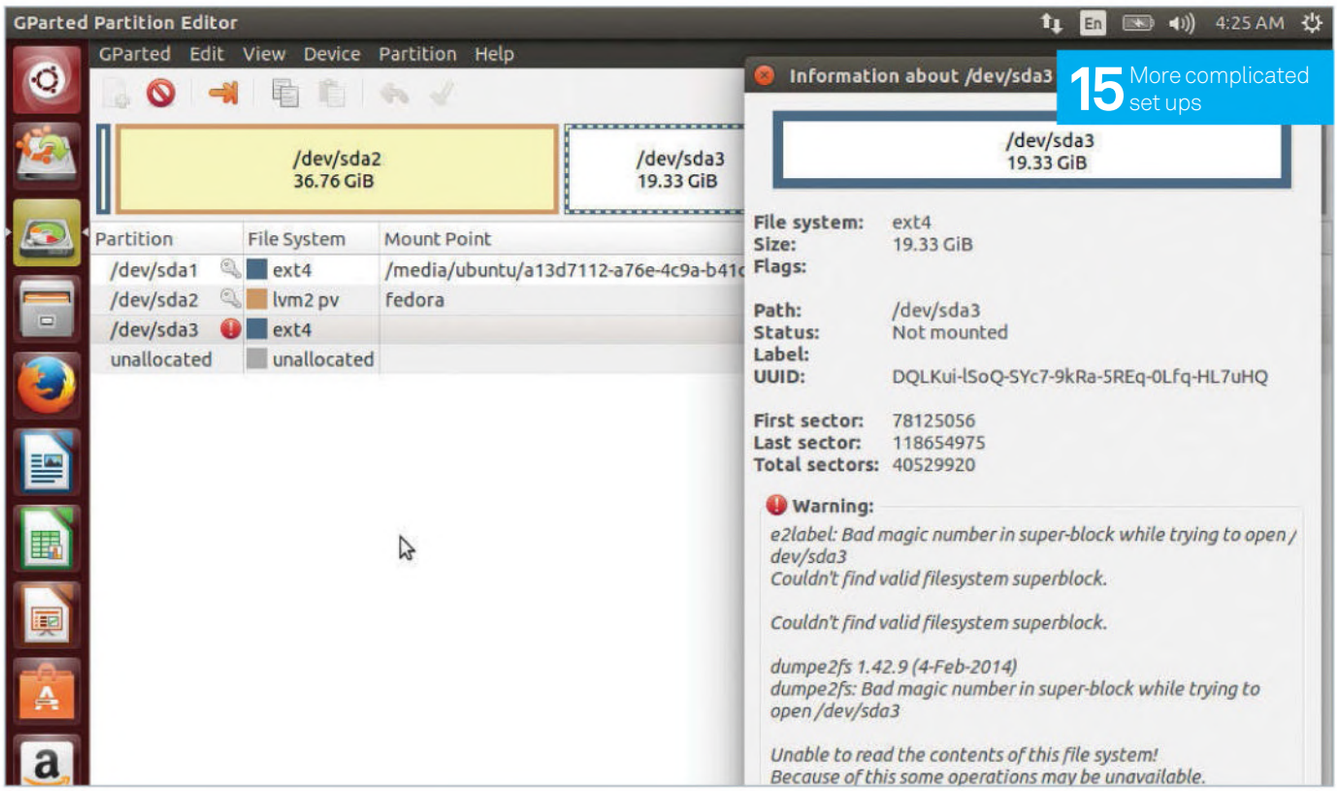
Ensure that you know exactly how much space you have to extend the partition by using **vgdisplay** to find the free PE (physical extent) value, and also make sure you know the name of the partition that you are extending. Once you have both of those, then use:

```
$ sudo lvextend -l +4958 /dev/fedora/root
```

12 Resize the file system

To finish off the extension, we need to let the entire LVM system know that it has had some changes using the resize option on the LV you've extended. The good thing is, this means you don't need to have space 'next to it' in the hard drive to extend in this way. Do this with:

```
$ sudo resize2fs /dev/fedora/root
```



13 File system check

Depending how the storage was created, you may need to check the integrity of the filesystem before the **resize2fs**. Here, it asked us to perform an **e2fsck** command on the extended LV before resizing – just follow the instructions.

14 Test your new filesystems

You can now see the extended space in the LV, the volume group and see if you have any spare space still to allocate using the **lvdisplay**, **vgdisplay** and **pvdisplay** options. In **lvdisplay** and **vgdisplay**, it won't show the extra sda partition because it's all part of the same storage as far as it's concerned.

15 More complicated setups

The beauty of LVM is that we can have several partitions and hard drives, have them all donate space to the volume group and then be divided between different LVs. You can create multiple LVs in any volume group, taking space where you want it. Adding hard drives later will let you extend the storage with little hassle. The partitions you create traditionally will show up as ext or whatever filesystem in the partition editors, but they'll be inaccessible outside of the LV.



16 Delete an LV

Want to completely rearrange the insides of your volume group? Start by deleting LVs to create them from scratch using the **lvremove** command. Make sure you know the name of the LV you're removing and do it like so:

```
$ sudo lvremove /dev/[volume group]/
[logical volume]
```

17 Remove a volume group

Need to go a step further and delete the entire volume group? This will delete all the LVs within and free up some of the partitions that are in the physical volume. Make sure you know the name of the volume group and then do:

```
$ sudo vgremove [volume group]
```

18 Get rid of the physical volumes

If you want to remove the LV completely, you can just delete the physical volume designations and then start using a more traditional partitioning system instead. Make sure you know the original names of the partitions and remove them:

```
$ sudo pvremove /dev/sda1 /dev/sda2 [etc]
```

19 Shrink the logical volumes

Like we did with the expanding, you can also shrink the logical volumes and volume groups. In each case, you would be reducing the size of the logical volume or removing physical volumes from the volume group, respectively – otherwise it works the same way.

20 Logical volume management

There are more functions you can use while creating and maintaining an LV, but these are the basics. If you find yourself running through a lot of storage then this may be the solution for you, as you can just keep adding with little-to-no hassle and no RAIDs.

Take command-line control of your email with Mutt

Email is one of the biggest time users, but Mutt offers the tools to sort and process your inbox

A few years ago, social media started to take up more of our time and you may have felt that email was diminishing in importance. However, we still spend hours each week wading through emails, and have to sign up for all sorts of commercial mailings just to complete the obligatory registration on many new websites and services.

The other big change has been a near wholesale move to webmail – a contracting out by mail users of running both the personal mail server and the client (and associated backups) to Google, Yahoo! and Microsoft, worryingly at the cost of control and privacy.

Webmail is convenient in the sense that we no longer have to think about looking after our emails, but despite some lovely interfaces, it remains at best a clunky and slow way of managing a busy email life. Mutt offers you the chance to take back control of your email and really speed up your workflow. We'll show you how to do this with one of the major webmail services.

Mutt is very powerful – the manual takes hours to read – but dive in with our quick tour of a few of its powerful features and you'll be ready to explore more deeply.

Resources

Mutt
mutt.org

Fetchmail (optional)
www.fetchmail.info

Mutt manual
mutt.org/doc/manual.txt

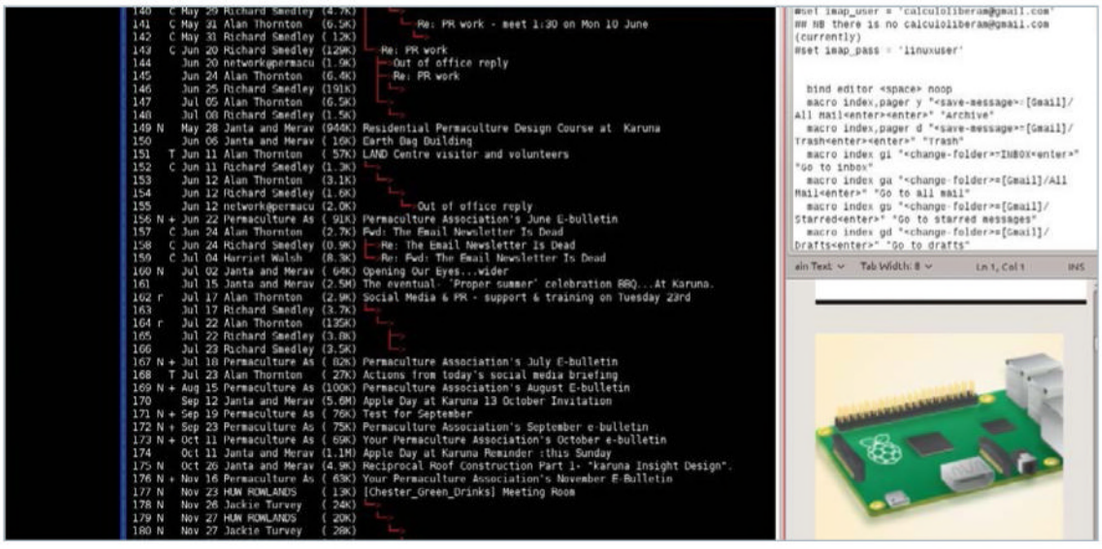
01 Set up IMAP

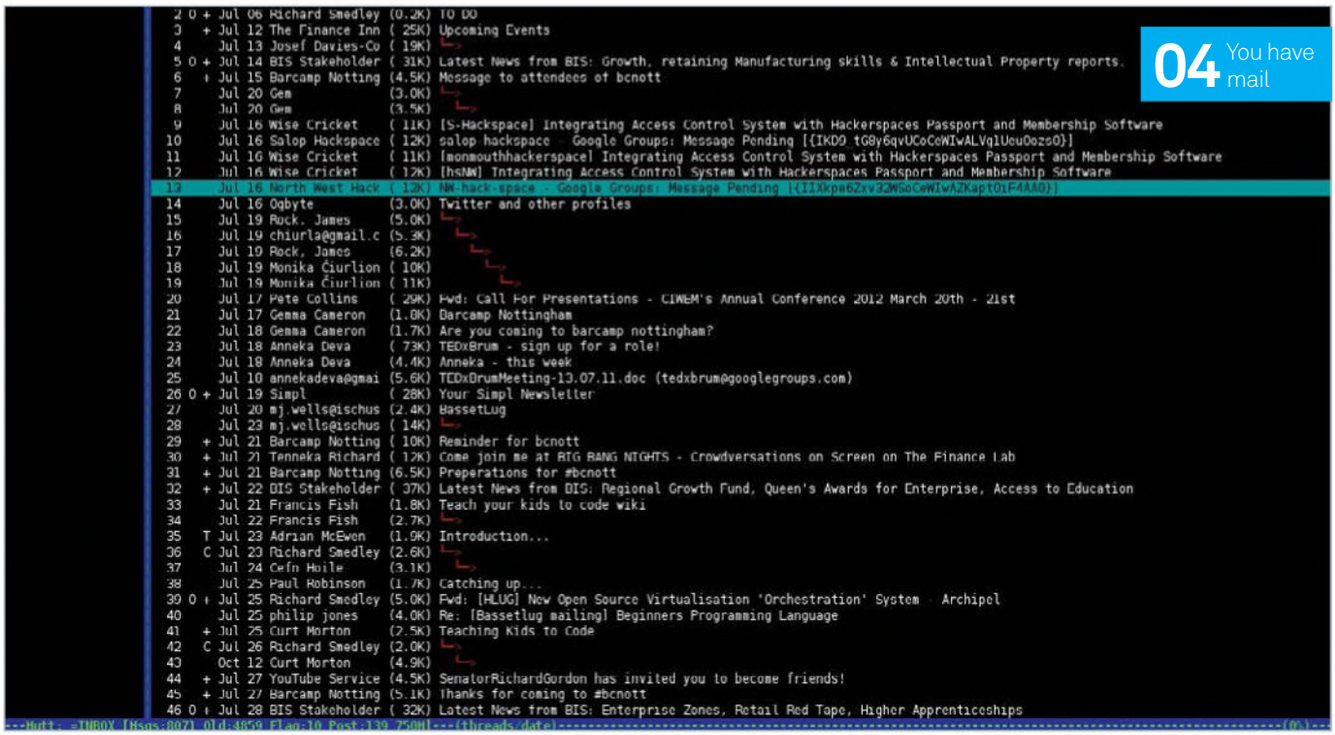
Before Webmail became ubiquitous, users had to decide between keeping their emails on the server to read anywhere – with IMAP (Internet Message Access Protocol) – or downloading them to a mail client through POP, and deleting them from the server.

Generous disk allowance means that many of us now keep all of our mail archived with webmail providers. However, you'll still need to enable IMAP in Gmail if you want to use it with a client like Mutt, yet still keep your emails available on Google's capacious servers.

Choose Forwarding>POP/IMAP in the Gmail settings menu and then select Enable IMAP. Yahoo! (and thus BT) does not need this lengthy process, nor do AOL or Hotmail Live either, which is useful.

Below Mutt shows you useful information about your emails in the main list, such as their size, and you can shortcuts to power through them all





02 Config file

To get up and running quickly, having already installed Mutt from your package manager, open ~/.muttrc in your favourite text editor and fill in the basics:

```
set from = 'your-account@gmail.com'
set realname = 'You'
set imap_user = 'your-account@gmail.com'
set imap_pass = 'your-secret-password'
set folder = 'imaps://imap.gmail.com:993'
set spoolfile = '+INBOX'
set smtp_url = 'smtp://your-account@gmail.com:587/'
set smtp_pass = 'your-secret-password'
```

Other providers need similar settings, for example:

```
smtp://your-account@hotmail.com@smtp.live.com:587/
```

03 Keep it a secret

Having your password(s) in a clear text file in your home directory is a security risk, particularly on a portable machine. Let's hide these passwords from the malicious or the merely curious. You should already have GnuPG installed on your system. Use it to encrypt a separate password file.

```
gpg --gen-key
cd ~/.mutt/
nano pwd
```

```
gpg -r your.email@gmail.com -e pwd
shred ./pwd
rm ./pwd
```

... with ~/.mutt/pwd containing:

```
set my_pwd="your_password"
```

Now replace .muttrc's password line with:

```
source "gpg -d ~/.mutt/passwords.gpg |"
set imap_pass = $my_pwd
```

04 You have mail

A little more housekeeping and we're ready:

```
mkdir ~/.mutt
mkdir ~/.mutt/cache
mkdir ~/.mutt/cache/bodies
nano ~/.mutt/sig
```

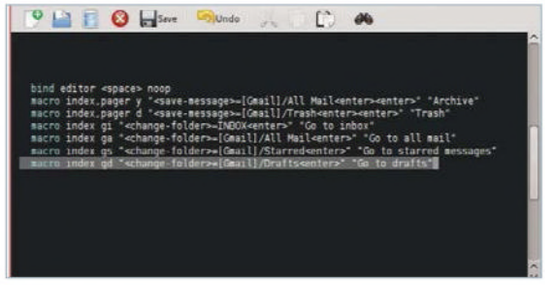
Now start Mutt, type **mutt** and hit Enter. If you've just set up a GPG-encrypted password, you'll be asked for the passphrase – gpg-agent will take care of it on subsequent occasions. If you're not a Zen-like practitioner of the art of inbox zero, you'll need to wait a few seconds for the thousands of messages you've enabled Gmail to hang on to, then be presented with a long list of your inbox's contents.

Above Mutt has a threaded mode that adds functions for long conversations

Already included

While we recommend getting Mutt's documentation later in Step 12 – or better still, keeping it open while using this tutorial – most distros will install plenty of the docs for you in a folder under /usr/share/doc/mutt/ examples, where you'll also find some great sample muttrc configurations, including useful colour schemes.

“Print a cheat sheet of the navigation keys or keep a window open on the Mutt manual”

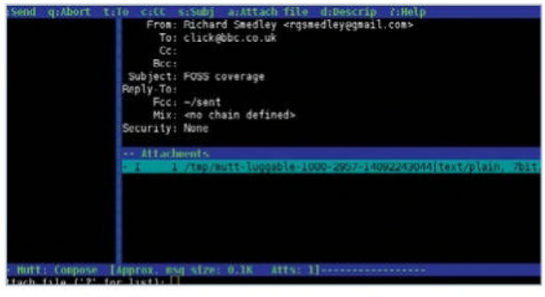


05 Keyed up

As you navigate around your email, K and J for up and down – inherited from the Pine and Elm mailers – means keeping your fingers on the home row. If you use a Dvorak or Colemak keyboard, you will want to rebind the navigation keys in .muttrc for your home row, using the following for Colemak, for example:

```
bind generic n next-entry
bind generic e previous-entry
```

Possibly replacing top-page (bound to H) and bottom-page (L) as well. Print a cheat sheet of the navigation keys or keep a window open on the Mutt manual until you've learnt the most useful ones. Initially, you can get a long way with Enter, Q (to quit) and the arrow keys.



06 Send an email

Test your config by sending an email. Hit M to compose, which will prompt you for recipient and subject, then open up your default text editor (Mutt is a mailer; composition is a text editor's job). Saving the message returns you to the send dialog, then hit Y to send or use various options for cc, attachments and more.

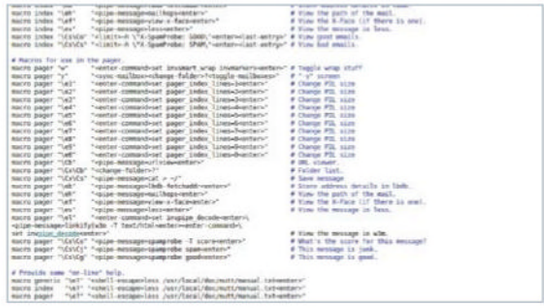
You may now be in the Drafts folder of your email account. Hit C to change mailbox, then ? to get a list of choices and navigate back to your inbox. Having rushed through the basics, let's see some of Mutt's real power.

Mutt in a hurry

Need to quickly copy a file from your server? Just issue this at the command line to send it to your log file home:

```
mutt -s “VPS Syslog file” -a /var/log/syslog -- me@my-email.com
```

Press Enter to confirm your choices then Y to send. Mutt enables many attachments from the command line, so following them with the double dash (--) tells it that you have finished attaching and that it should pay attention for the address.



07 Macro power

Command line apps are amenable to automation in a way that mouse-driven programs can't be. A macro saves a series of keystrokes normally applied to Mutt interactively, such as those to open a mail and then its attachment(s), all bound to a keyboard shortcut.

Macros are defined in .muttrc with the form:

```
macro menu key sequence [ description ]
```

... where 'menu' is Mutt-speak for the part of Mutt you're using – the pager, index view, composer, attachment, etc. In Step 5 we used **generic** as a meta-menu for all menus where common navigation functions are available; you can define the same macro for each menu you need it in. 'Key' is your defined shortcut key – \C is the Control key and \e is Escape, so if you wanted to bind a sequence to Ctrl-x, Ctrl-c, you'd need \Cx\Cc. When using a sequence, you put in the function names (rather than their common keyboard shortcuts) within angle brackets.

If there is a space used anywhere, then the whole sequence needs quoting:

```
macro index,pager <f1> “<shell-escape>less /usr/local/doc/mutt/manual.txt<enter>” “Show Mutt documentation”
```

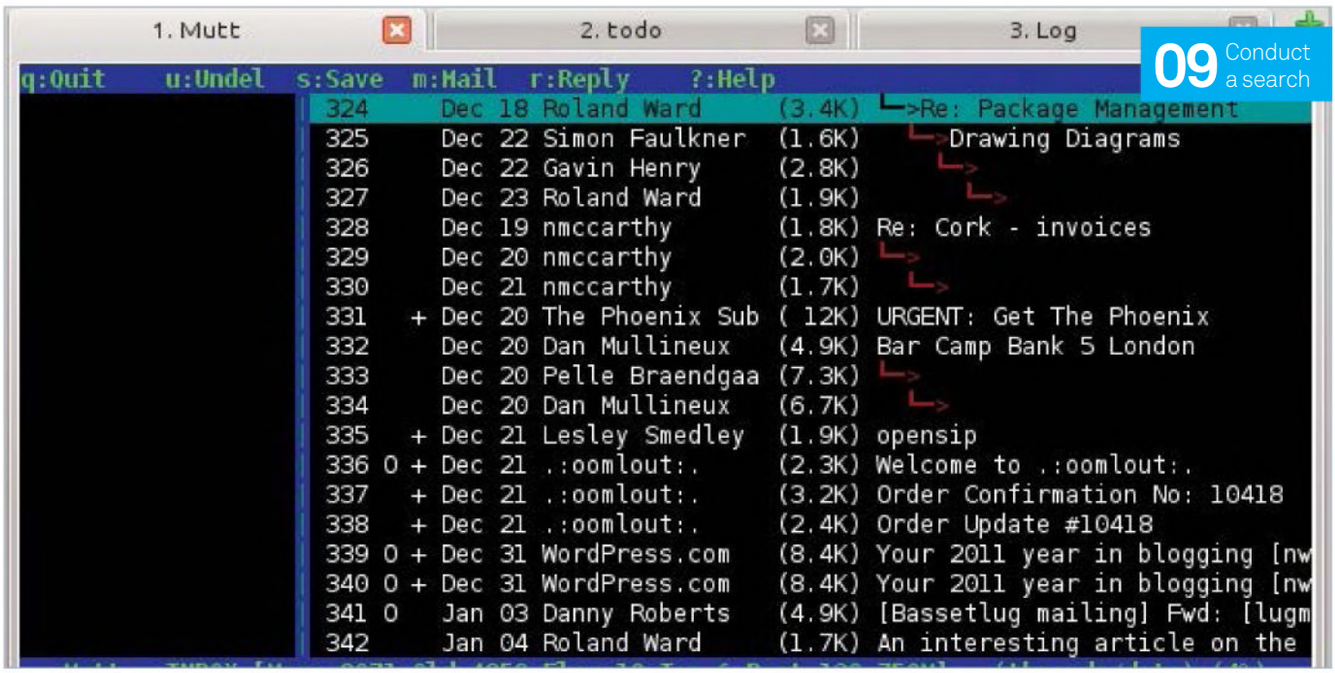
The description at the end is optional, but makes life easier.

As with dot-files (including .muttrc), your favourite search engine will find you several examples, much like those displayed in our screenshot.

08 One tag to rule them all

Scrolling through your messages you notice half a dozen that can all be treated the same way – moved or deleted, for example – something that would be a pain if navigating with a mouse. In Mutt, hit T on each message to tag them and, when you've finished tagging, hit ; followed by D to delete them all, or else use some macro on them.

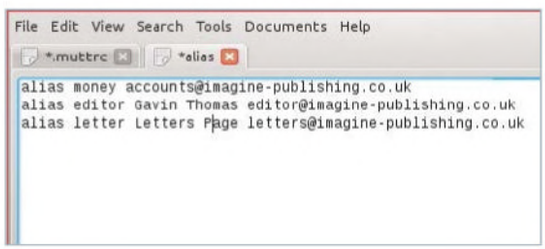
After hitting delete, you'll see that the asterisk which was showing the message(s) as tagged has been replaced with a D, indicating the message will be deleted when you leave Mutt. Why not delete it straight away? Maybe it gives you a chance to go back and change your mind – perhaps you tagged just one message too many.



09 Conduct a search

To search your emails, hit / and then type your search term or regular expression. Using T instead of / will tag all of the messages matching the search term, allowing for the same range of actions as the previous step.

It's worth reading the Mutt documentation for more on search – you can find and select mails by properties such as size or date, all of which are handy when your inbox has grown as large as Gmail provides for.



10 Create an alias

As you start typing an email address in your webmail, all the likely completions will pop up. The Mutt equivalent is to define an alias for each person to whom you need to write messages regularly:

```
alias bank Bank Manager manager@barclays.co.uk
```

The first word after alias is your shortcut, everything else between that and the actual address is the long-form name.

Typing the shortcut at the To: prompt, when you're composing an email, will cause Mutt to substitute the long name (if given) as well as the email address. If you've several aliases collected, give them their own file and let .muttrc know where it is:

```
set alias_file=~/.mutt/aliases
```

11 PDF

Your /etc/mailcap file tells your email clients how to handle multimedia attachments. Hit V to read a PDF attachment and the system default (probably Evince or Okular) will open. If you're running Mutt in a command line environment, you'll need to make a custom mailcap in ~/.mutt/mailcap to specify piping **pdftohtml** through **w3m**. You'll need to point to this in .muttrc with:

```
set mailcap_path="~/.mutt/mailcap"
```

The output is not properly formatted, but at least the content is now readable.

12 The next step

While trying to cover useful tips for new Mutt users, we've had to adopt a scattergun approach – the idea being to get you started, at least. However, we've missed out a lot of deeper configuration and many powerful uses of this flexible mailer. Fortunately, the next step is easy: read the Mutt documentation at **http://dev.mutt.org/trac/wiki/MuttGuide**, as well as accompanying manual and wiki pages.

There's a lot of it for someone who's never used Mutt before, but you already have a working setup and know some power user tricks, so you're ready to really go and tame your inbox.

Above Filtering emails by date and searching for keywords really speeds things up

Run your own chat channel with Scrollback

Scrollback builds chatrooms that enable you to communicate and engage new audiences

Communication is one of the most important aspects of our lives. Whether you think of peer-to-peer communication or a brand communicating to its audience, it's important to convey things effectively. The rules are simple: whoever communicates well wins.

With the digital world now handling most of our communications, it's important to choose the right words and have the right tools, because without these there's no way that your audience can understand you. One of the common communication tools is the chat application. Generally based on a server-client model, such tools are available a dime a dozen, but each tool has a problem – some look ugly, some don't support chatrooms, and some are based on the IRC protocol only. There is rarely an application with everything in one package. However, we will cover one here that can help you do it all – from chatrooms to embedding, websites to chat archiving, everything you'd expect from a chat application, with a new UI. Scrollback, based on a server-client model, has a web-based UI that opens in a browser with no need for a client application. We'll go through the installation and its features in this tutorial. We have used Ubuntu 14.04 as the host system and the latest source code from Scrollback's GitHub repository.

Resources

Scrollback
scrollback.io

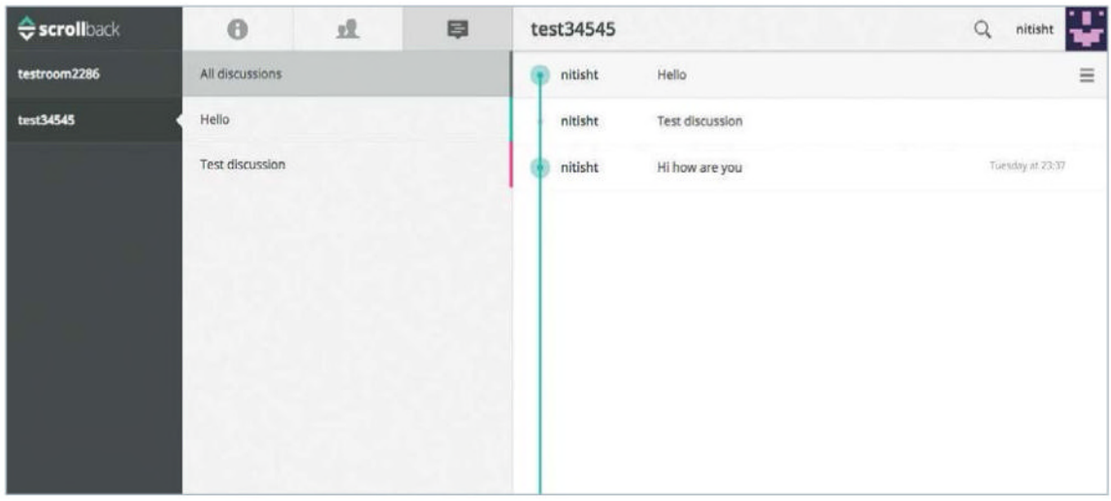
GitHub repo
bit.ly/1GlTLfP

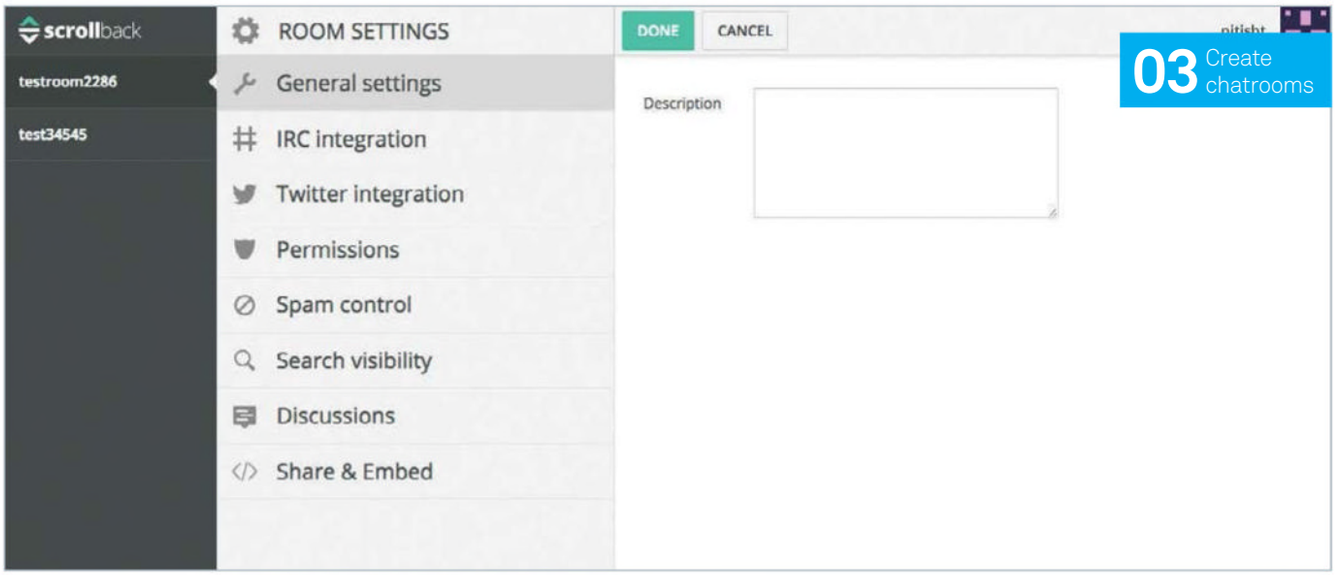
01 Install the script

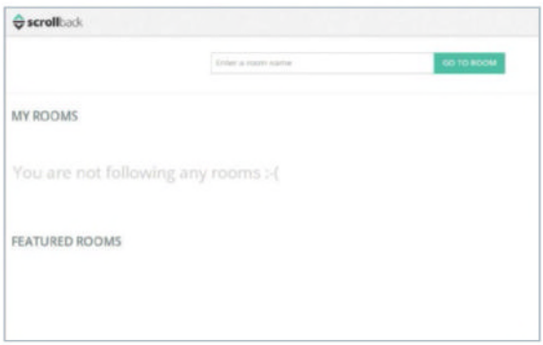
Installing Scrollback is pretty straightforward; you can just go to their GitHub page and run a single-line command that's available there to instantly install Scrollback on your server. The command basically invokes a script where all the action happens. Now, we as open source enthusiasts can't just let that happen so easily! This is one of the most exciting parts of open source software. You can view the code and take charge, rather than just clicking things away. However, if you are just interested in running Scrollback immediately, you can skip to Step 3.

Let's take a look at what happens when you run the script. It starts with trapping signals and sanity checks, like a user privilege check and supported distros check – supported distros are Ubuntu, Arch Linux and Fedora. If you are running something else, you need to manually install Scrollback. In the next step we'll take a look at the various dependencies of Scrollback and their installation in the script.

Below Scrollback provides a neat, clean interface to manage all your conversations





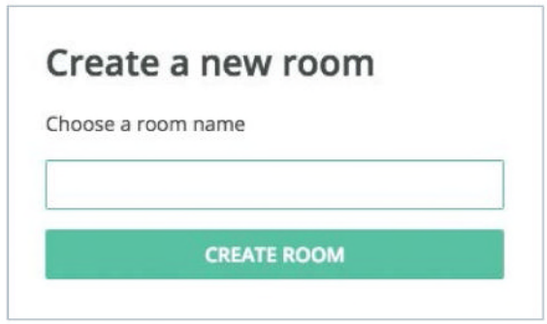


02 Behind the scenes

After a sanity check, the installation script shows the list of items to be installed – Git version control, Node.js and Redis server. Click Install to grant permission. Once you grant the permission, it checks for the sources list for Ubuntu using `sudo apt-get update`. Then it goes through all the packages and installs the ones related to Git, Node.js and Redis. Then, Scrollback is cloned from the GitHub repository and the dependencies, like gulp-bower, are installed. The Redis daemon is started and local.scrollback.io is added to the /etc/hosts file. This enables you to access Scrollback in your browser using the address **http://local.scrollback.io** instead of using an ip address.

Finally the configuration files are copied and Gulp is run to generate miscellaneous files, followed by a notification of successful Scrollback installation. Once the installation finishes, run `sudo npm start` to start Scrollback. You can access Scrollback in your browser now. Note that you may see a New Relic-related failure when starting Scrollback, but you can safely ignore that. Let's now take a look at some of the features of Scrollback.

"In simple terms, the whole chatroom is miniaturised and can be accessed via a small window on the website"



Left Organise your chatrooms by giving them unique, descriptive names

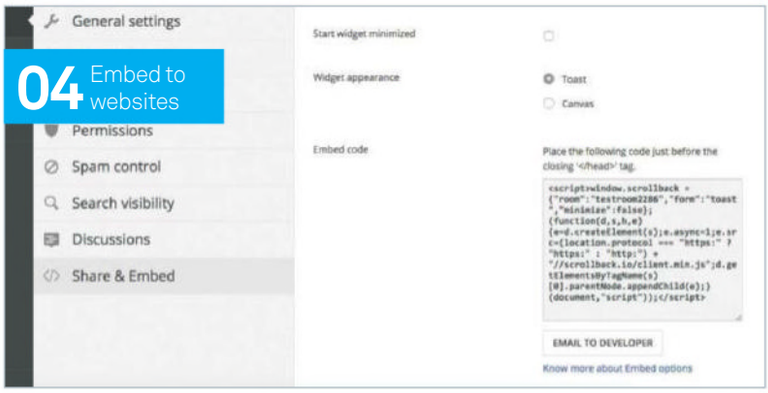
03 Create chatrooms

The next step is to create a chatroom. To create one, you will need to log in to Scrollback – note that you will need to use email login, since Facebook and Gmail login options don't work out of the box. Once logged in, click on the Create Room button in the bottom-left corner or the centre of the page. You will be prompted to fill in the room name, so just enter the name. Your chatroom will then be created and the page redirects to the room settings.

Room settings in Scrollback include several options: IRC, Twitter integration, spam control, search visibility options, discussion settings, embedding and sharing settings and so on. We will take a closer look at the various settings in the next steps.

Social accounts

To enable Google+ or Facebook login for your Scrollback installation, you will need to create a developer account and generate the API keys that enable an application to access the services. You will then need to save the keys in the server-side configuration file.



Above Embed a small chat window on your site using ready-made code

04 Embed to websites

Another great thing you can do with Scrollback is embed the chat window directly in your website. In simple terms, the whole chatroom is miniaturised and can be accessed via a small window on the website. Embedding the chatrooms on websites gives you an opportunity to engage more people in an easy-to-manage manner. This is far better than an email-based subscription because it allows for instant communication and possibly a better experience overall. Your website visitors can also take advantage of all the information already available in your chatroom. They just need to see the discussions list and click on the one relevant to them in order to use it.

To embed your chatroom in a simple HTML-based website, go to the Share & Embed tab in the Room Settings page. Scroll down to view the embed code – yes, it is already there! Now copy and paste it in just before closing the </head> tag in your website. That's all it takes; your visitors can now see a miniature version of your chatroom on your website. There is also the option to add a whitelist of domains where the room can be embedded. If you leave that field empty, you are implying that you will be enabling embedding anywhere, which isn't ideal.

05 WordPress websites

WordPress powers around 23 per cent of the whole Internet. That is a very vast number, and with that comes the opportunity for you to engage visitors in meaningful conversations within a community, rather than just one-to-one chats. Scrollback does well to take advantage of this medium – you can very easily integrate your Scrollback chatroom to a WordPress website, this time without even touching a single line of code.

To use Scrollback with WordPress, log in to your WordPress admin console and go to Plugins>Add New> Search Plugins. Type Scrollback here and start the search. You will then find the Scrollback plugin, so just install and activate it. Once it's activated, fill in the name of your chatroom (the room that you want to embed to your site), and that's it! Go to your WordPress website and you will now be able to see the Scrollback chat window in the bottom-right corner of your website.

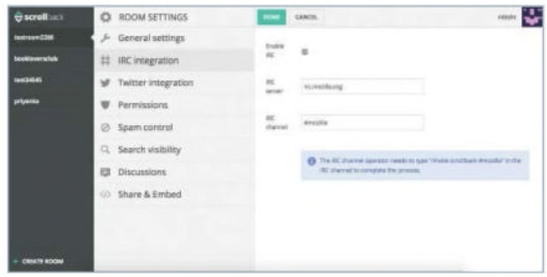
Index for searching

You can also choose if your chatroom is available for room search indexing. To enable search engine indexing, go to the Room Settings menu's Search Visibility tab and enable the 'Allow search engines to index room' option, then click on the Done button.



06 Use Blogger

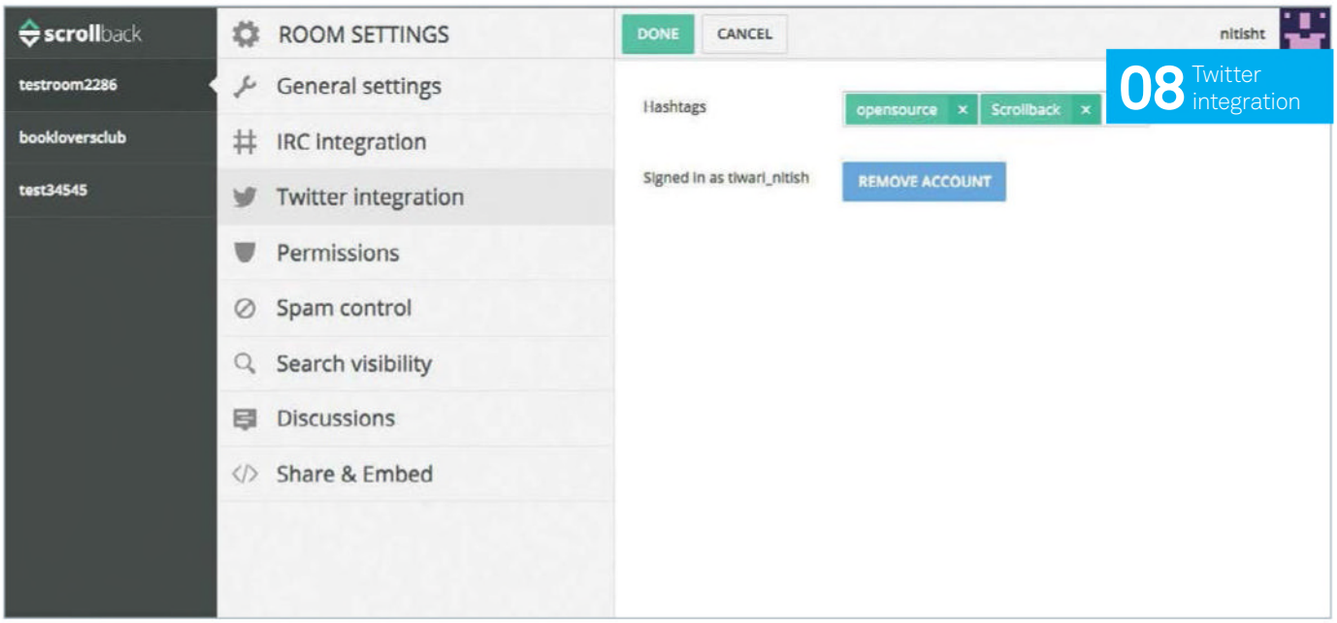
Several bloggers prefer Google's **blogger.com** instead of taking the pain to host their own WordPress or other CMS based websites. Lets see how to add Scrollback rooms to a **blogger.com**-based website. As we did in Step 4, you will first need to copy the code snippet from ScrollBack. Once you have your code snippet copied, go to your **blogger.com** account, then Options>Layout>Add a Gadget. On the next page, select HTML/JavaScript. Finally, just paste the code to the content section and click Save. Your **blogger.com** website is now integrated with Scrollback.



07 Link IRC channels to Scrollback rooms

IRC (Internet Relay Chat) remains a tried and tested way to maintain a healthy communication among community members. The process is simple – people can install IRC clients and connect to the server. They can then follow relevant channels. However, IRC usage has been falling recently. According to Wikipedia, IRC has lost 60 per cent of its users and 50 per cent of its channels in the last decade. Such decline may be attributed to the rise of various other forms of community management, such as Facebook groups, Twitter lists, Whatsapp groups and so on.

Scrollback aims to bridge this gap between IRC and non-IRC users. It enables you to link your existing IRC channel to a Scrollback room and reach out to the non-IRC users, giving them an easier entry point to your community. This also enables you to make use of Scrollback's logging features and help track discussions easily. To link your chatroom to an IRC server, go to Room Settings>IRC Integration. Fill in the IRC server link (eg irc.mozilla.org) and the IRC channel (eg #mozilla), then click Done to save the changes. The IRC channel operator needs to type **/invite scrollback #mozilla** in the IRC channel to complete the process, replacing #mozilla with the channel name that you entered. Once this is done, you can see the IRC messages in the chat window in your chatroom.



08 Twitter integration

Scrollback offers a tight integration with your Twitter account. You can watch hashtags, tweet chat messages directly from chat window and even share your chatroom via tweets. So let's see how to achieve all this. First go to the Twitter integration tab and enter the hashtags that you'd like to watch, separating hashtags with spaces, and click on the 'Sign in to Twitter' button. Then, in the Twitter window, log in and review the privileges – that's it. You can now see all of the tweets that have the hashtags you want to watch right inside your chatroom.

If there is a message in your chatroom that you want to tweet, just hover on the message to reveal a menu icon on the extreme right side of the page. Then click on this icon to show the different options – you can either choose to tweet the message or hide it. To share your room via tweets, go to the Share & Embed tab and click on the Twitter button under 'Share your room'.

09 Moderation features

You can set the room description under the General settings tab. Since Scrollback is designed in a search engine-friendly way, it is very important to set the description properly. The Permissions tab lets you decide on people who can post in your chatroom. You can select anyone, or only the logged-in users or followers of the chat room.

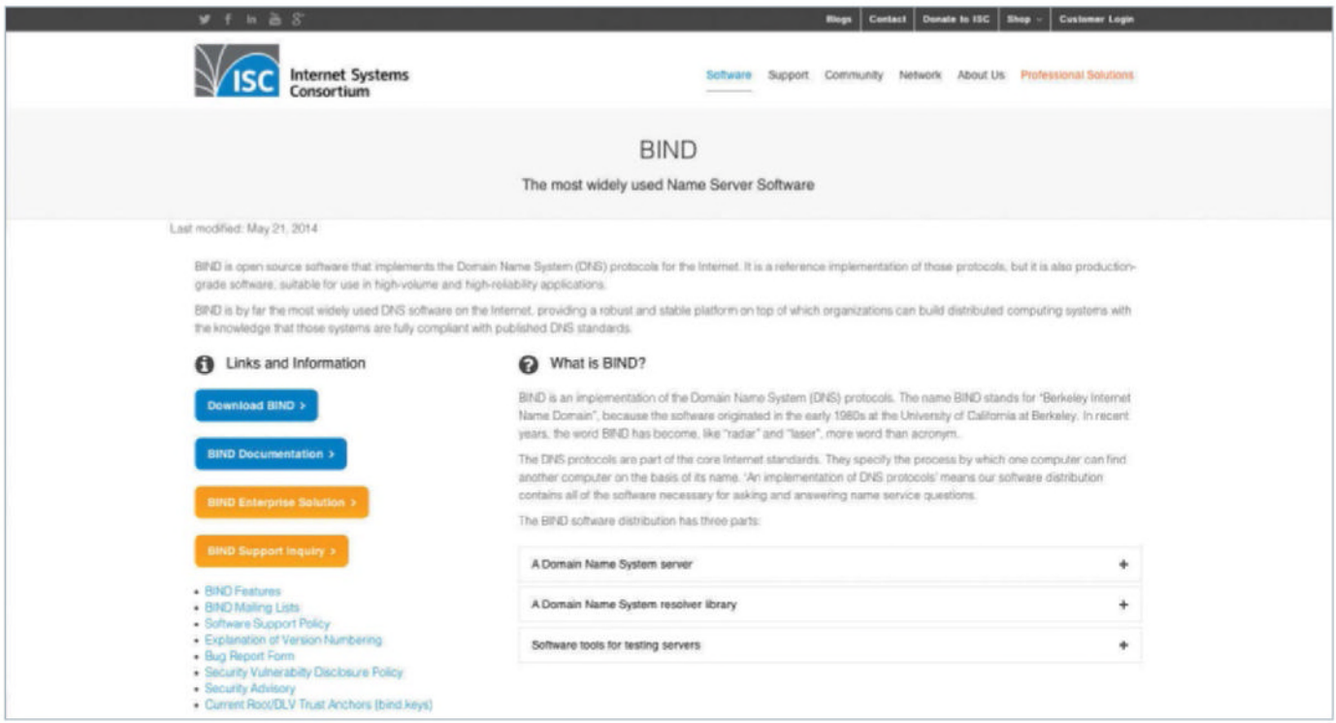
One of the major concerns a chatroom moderator faces involve spammers and abusive behaviour. Scrollback enables moderators to control such issues easily – just enable the Spam Control button under the Spam Control tab, and Scrollback automatically blocks spammers from posting to your group. In the same tab, you can also set the blocked words list. If you enable the 'English abusive words' option, only the predefined words are blocked. You can make additions to the block list by entering the abusive words in the 'Custom blocked phrases/words' text area. Now even if people type abusive words into the chatroom, they won't be visible to anyone else.

"It may happen that different people discuss different things. If you follow IRC channels, it's a really common scene in there"

10 Discussions

One of the prime issues in a chatroom is tracking the discussion. A room generally has many people in different time zones. It may happen that different people discuss different things in parallel – if you follow IRC channels, it's a common scene in there. In such scenarios, it becomes really difficult to track or get meaningful information out. If you have not noticed till now, Scrollback solves this problem in a very simple yet effective way. Just go to the Discussions tab and enable 'Automatically group text into discussions'. Now, Scrollback automatically segregates discussions based on words in chat messages and the user who types them. At any point, any user can create a discussion too simply by clicking on 'Start a discussion' in the chat window. All the discussions are archived under the Discussion tab on left side. To view one, simply click on the discussion name – the chat window shows all the messages under that discussion in a useful colour-coded format.

Above Add Twitter hashtags to your settings to view the related tweets inside your chatroom



Above Check out **bit.ly/1tr9kbv** for documention on BIND

Create a caching DNS server for query requests using BIND

Reduce your network traffic and serve DNS requests faster by running your very own caching DNS server

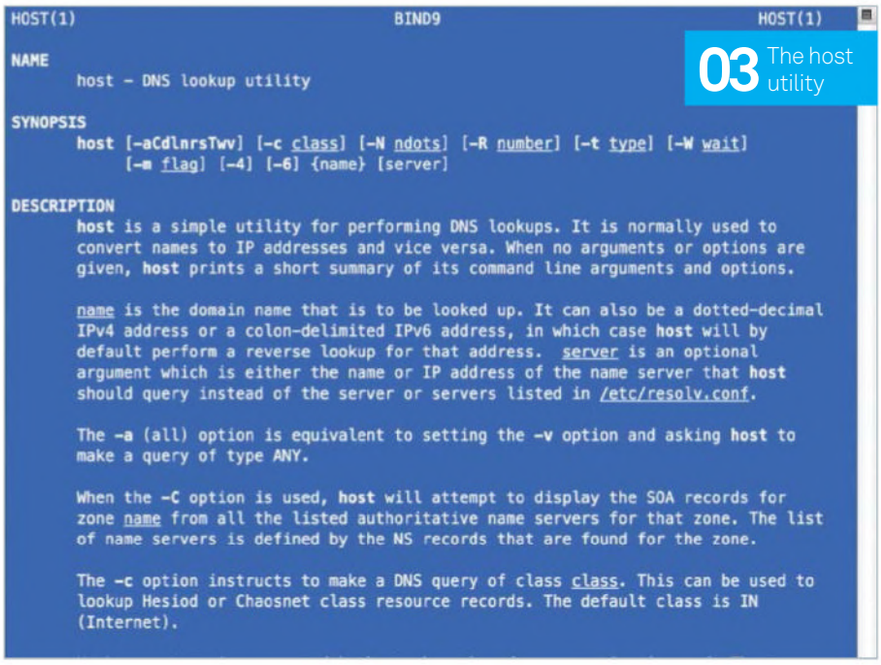
Resources

BIND home page
www.isc.org/software/bind

RFC 1034, Domain Names
tools.ietf.org/html/rfc1034

RFC 5936, AXFR
tools.ietf.org/html/rfc5936

DNS (Domain Name System) is what converts a human readable string to an IP address (and vice versa) – when it does not work properly, you cannot browse the Internet or get your email. Machines called DNS servers, or simply name servers, support the Domain Name System. These machines are nothing extraordinary except the fact that they run special server software to support DNS. A network device must have at least one properly configured DNS server in order to operate normally, but for added redundancy you should use more name servers to ensure that the network device is operational regardless of any problems. A name server should always be stated with its IP address. A DNS zone is a part of a domain name that its administration has been delegated. So, the .co.uk domain has many zones. It is very reasonable that the .co.uk domain administrator delegates the administration of all subdomains because otherwise it would have to administer all the .co.uk subdomains, which, as you can imagine, are numerous.



03 The host utility

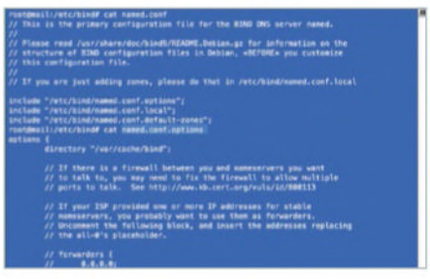
01 Install BIND

BIND stands for Berkeley Internet Name Domain and is an implementation of the DNS protocols. On a Debian 7 system you can install the latest version of BIND by running the following command:

```
# apt-get install bind9
```

To find your version of BIND, execute the following command:

```
# named -v
BIND 9.8.4-rpz2+rl005.12-P1
```



02 What is Cache DNS server?

A caching-only DNS server does not contain information about a domain; it just contains information based on the results of the DNS queries it has already performed. The main reason that DNS caching works well is because DNS data does not change frequently.

03 The host utility

Host produces a clean output and that is the main reason for liking it – it can easily be used inside shell scripts. Its last parameter, which is optional, is the name of the DNS server to ask. If not given, it uses the /etc/resolv.conf file to find a DNS server to ask.

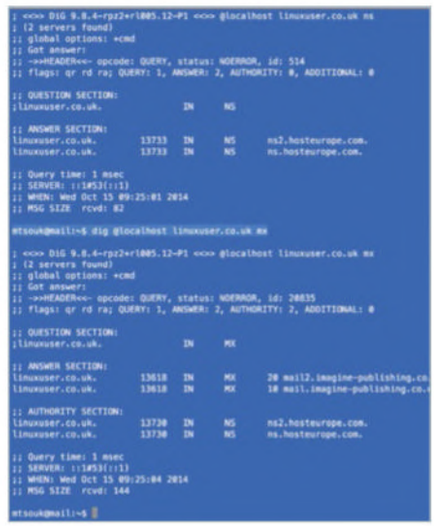
Used with the **-t mx** parameters, **host** shows the mail servers for a domain or a subdomain:

```
# host -t mx linuxuser.co.uk
linuxuser.co.uk mail is handled by 10
mail.imagine-publishing.co.uk.
linuxuser.co.uk mail is handled by 20
mail2.imagine-publishing.co.uk.
```

The numbers that you see after the "handled by" are the preference values that indicate the mail exchanger's priority. A preference value by itself is not important, what is important is its relationship to the other values.

Mail servers should attempt to deliver to the mail exchangers with the lowest values first. If the delivery fails for some reason, then the mail exchanger with the next highest value will be tried. If two or more mail exchangers have the same preference value, it is up to the mail server to decide which one to choose. The primary DNS server is responsible for defining the email server for a domain or a subdomain.

Used with the **-t ns** parameters, host shows the DNS Servers for a domain.



04 The dig utility

The **dig** utility can show you the same DNS related information as host, however, dig's output is more populated by default. In order to find the DNS servers of the co.uk domain with the help of dig, you could do this by executing the following command:

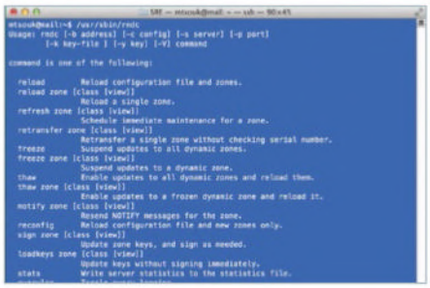
```
$ dig co.uk. ns
Trying to perform a AXFR query with dig
fails:
$ dig @localhost co.uk. axfr

; <<>> DiG 9.8.4-rpz2+rl005.12-P1 <<>> @
localhost co.uk. axfr
; (2 servers found)
;; global options: +cmd
; Transfer failed.
```

AXFR is a mechanism for replicating DNS data across DNS servers, but it can also be used for evil purposes. The DNS Administrator is responsible for allowing the access to the AXFR protocol to specific machines and restricting it to the rest of the world.

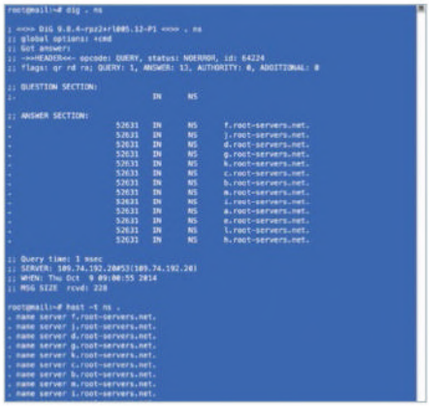
05 The /etc/resolv.conf file

The quickest way to see your DNS configuration is by looking at the /etc/resolv.conf file, where you can see the IP address for each DNS server used; each entry starts with the nameserver keyword. There is no point in using anything but an IP address for a DNS server. Usually, the administrator deals with this file when setting up a Linux machine; otherwise it is populated when your Linux machine gets its network configuration using DHCP.



06 The rndc utility

The **rndc** executable is the name server control utility. It controls the operation of the name server and it communicates with the named process using a TCP connection. The rndc utility has a configuration file called rndc.conf that has structure and syntax similar to named.conf. You can type **man rndc-confgen** and **man rndc.conf** for more information.



07 Other types of DNS servers

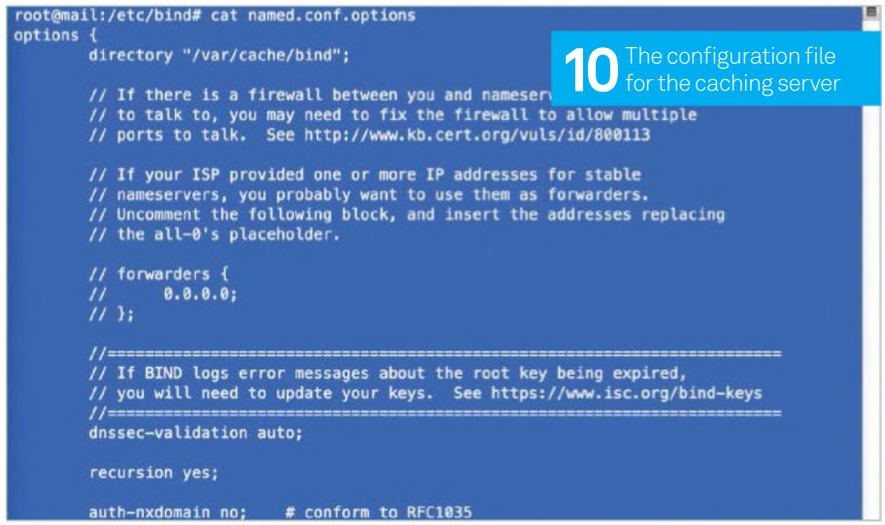
There are three more types of DNS servers: primary, secondary and forwarding. Each domain should have at least one primary and one secondary DNS server.

A primary DNS server (or Master) defines one or more zone files for which this DNS is authoritative. A zone has been assigned to a DNS server using an NS Resource Record.

A secondary DNS server (or Slave) mainly acts as the backup of the primary DNS server in case it goes down for some reason.

A forwarding DNS server is almost identical to a caching server from the perspective of a client. Its difference is that it does not perform recursive queries itself; it just forwards them to another DNS server, gets the response back and then caches the results.

It is not possible to find out from a query result whether it was answered from a zone master or from a slave.



10 The configuration file for the caching server

08 The /etc/bind directory

All configuration files related to BIND are located inside the /etc/bind directory. You will need root access to make changes to it and you will have to restart the named process for the changes to take effect.

BIND keeps some other files inside /var/cache/bind:

```
# ls -l /var/cache/bind/
total 24
-rw-r--r-- 1 bind bind  698 Oct 15 09:46
managed-keys.bind
-rw-r--r-- 1 bind bind  512 Oct 15 09:46
managed-keys.bind.jnl
-rw-r--r-- 1 bind bind 9446 Oct 15 11:17
named_dump.db
-rw-r--r-- 1 bind bind 1103 Oct 14 10:58
named.stats
```



09 The /etc/bind/db.root file

The db.root file holds the information on root name servers, denoted by a single dot, needed to initialise the cache of internet domain name servers. You can manually generate it by running the following command:

```
$ dig @a.root-servers.net . NS > db.root
```

10 The configuration file

The default BIND configuration is almost ready to support a caching DNS server. You will only need to explicitly turn recursion on and then it will all be done. This action can be completed by adding a line inside 'named.conf.options' that contains the 'recursion yes;' text.

The next step then is to run the BIND server process as follows:

```
# /etc/init.d/bind9 start
```

You will also need to add an access control list to reduce traffic and increase security, and you will learn about access control lists a little later on in Step 14. The DNS service will usually listen to port number 53, as you can clearly see from the following output:

```
# telnet localhost 53
Trying ::1...
  Connected to localhost.
```

11 Manage the caching DNS server

You already know how to start the DNS server. The following command stops it:

```
# /etc/init.d/bind9 stop
```

And then this command restarts it:

```
# /etc/init.d/bind9 restart
[....] Stopping domain name service...:
bind9waiting for pid 24713 to die
. ok
[ ok ] Starting domain name service...:
bind9.
```

```
$ host -t ns linuxuser.co.uk linode
;; connection timed out; no servers co
rMacBook:Downloads mtsouk$ host -t ns
Using domain server:
Name: linode
Address: 109.74.193.253#53
Aliases:

linuxuser.co.uk name server ns.hosteurope.com.
linuxuser.co.uk name server ns2.hosteurope.com.
$ host -t ns linuxuser.co.uk linode
Using domain server:
Name: linode
Address: 109.74.193.253#53
Aliases:

Host linuxuser.co.uk not found: 5(REFUSED)
```

14 Access control lists (ACL)

"All log messages from BIND are stored in /var/log/syslog"

12 Use the caching DNS server

A caching server is used like a regular DNS server. If you want to reduce the DNS traffic on your LAN, you should put the IP of the caching server in the /etc/resolv.conf file and comment out all other DNS servers. However, this can be dangerous because if the caching DNS server stops working for some reason, your network will not be able to operate normally.



13 The log files of BIND

All log messages from BIND are stored in the /var/log/syslog file. The **named** command can produce a large amount of log messages, so you might decide that you want to decrease the log level using **rndc** after making sure that your DNS server works without any problems.

14 Access control lists (ACL)

An **acl** list defines which hosts can and cannot access a DNS server. The following lines define a new access control list:

```
acl OTENET {
        2.86/16;
        localhost;
        localnets;
};
```

The definition of the list does not automatically make the list active. You should add the following line to turn on the OTENET access control list:

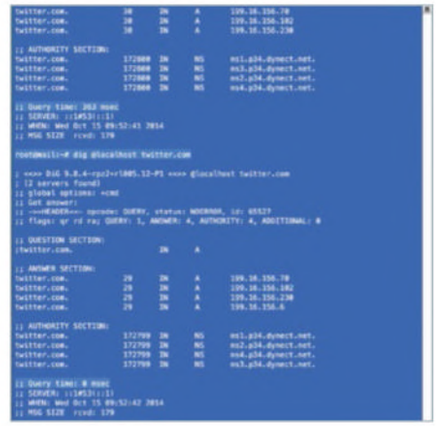
```
allow-query { OTENET; };
```

As soon as the DNS server starts running, many unknown hosts will try to connect to it; so do not delay generating as many access lists as needed to protect your DNS server.

15 Check your configuration

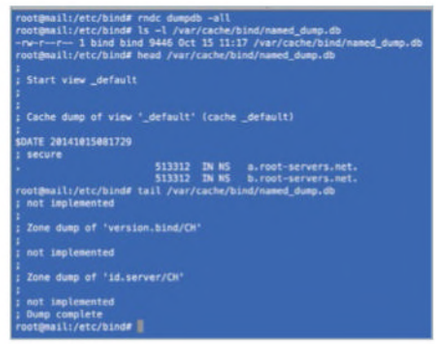
BIND comes with many tools that can help you to check the correctness of your current configuration. These tools include **named-checkconf**, **named-checkzone** and **named-compilezone**.

For the purposes of this tutorial, the most useful utility is **named-checkconf** which checks the syntactical validity of your configuration. If there are no syntax errors in your current configuration, you will get no output. No tool can catch logical DNS errors.



16 Test the cache DNS server

In order to test your DNS server, try to query a domain that is not the DNS cache and see how much time it takes to answer the query. Next, ask the same DNS query and you should see a way better response time.



17 Advantages of a caching server

The advantages of using a cache DNS server on your network are less LAN traffic and less Internet traffic. You also get DNS responses quicker for queries that have already been answered by the caching server.

BIND has a handy command to dump all the records of a DNS server to a single file. It can then re-read this data when it starts again:

```
# rndc dumpdb -all
# ls -l /var/cache/bind/named_dump.db
-rw-r--r-- 1 bind bind 9446 Oct 15 11:15
/var/cache/bind/named_dump.db
```



Program a client-server application

Each operating system provides its own set of networking APIs, but Qt gives a solution to simplify creating chatty applications

Modern computer networks are composed of multiple protocols. Creating well-formed packets by hand is almost impossible – the protocol stack and its underlying network hardware affect the format.

Engineers working on Unix solved this problem by introducing an abstraction layer – so-called sockets acting as endpoints between two local or remote applications. Developers use the standardised interface in order to provide commands to the socket, which are then translated to the network.

When dealing with sockets, a basic understanding of networking is beneficial. For now, it shall suffice to define that messages can be transmitted by two high-level protocols. TCP – short for Transmission Control Protocol – provides confirmation when data has been delivered successfully. This is accomplished by a relatively complex sequence of packets which add overhead to the communication process. However, some applications don't require this. For them, UDP provides a sleeker communication protocol that forgoes delivery confirmation. On a network, computers are identified by their IP address. Individual services are then identified by their port numbers – consider them apartment door numbers inside a high-rise building.

Developers working on communication software tend to face a chicken-egg situation – if no server has been written, the client can't connect. On the other hand, the lack of a client means that the server can't be tested.

In practical projects you should start out by creating a rough mock-up of the messages that the client and server will exchange. You don't need to get this 100 per cent right on the first try; most protocols change as they get implemented.

Our finger exercise-level applications don't require this level of sophistication. It will suffice to begin by creating a command line project called ImagineTCPServer. Qt Creator does not add the networking module to newly created applications. This can easily be remedied by opening its .pro file and adjusting the QT directive so that network gets included at compile time:

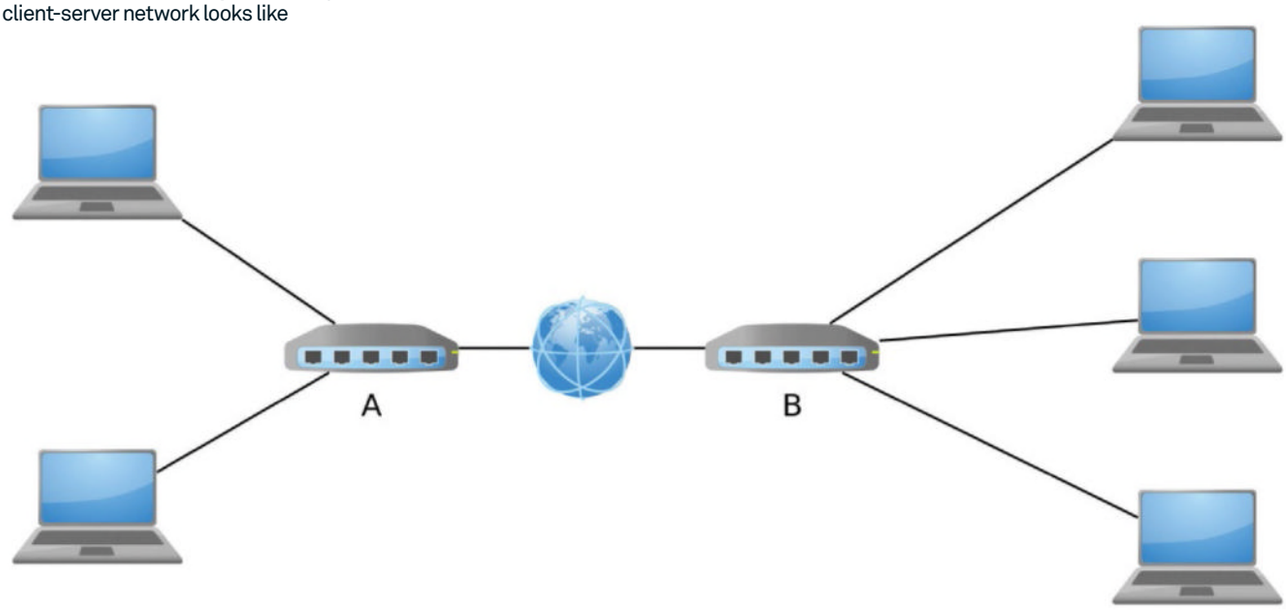
```
QT += network
```

With that, it is time to create the server object. Its declaration can be placed inside the main() function responsible for program bring-up:

```
myServer=new QTcpServer();
if(myServer->listen(QHostAddress::Any,102
5)==false)
{
    qDebug() << "Server error" <<
myServer->serverError();
    return 0;
}
else
{
    qDebug() << "Server up"  <<
myServer->serverAddress() << " " <<
myServer->serverPort();
}
```

In classic Berkeley socket programming, server and client logic are handled by instances of the socket class. Qt provides a dedicated server that contains helper methods for connectivity management. After start-up, we invoke the listen() method in order to make our QTcpServer wait for incoming connections.

Below This is, essentially, what an operational client-server network looks like



Passing in QHostAddress::Any makes the class listen on any network interfaces – you can constrain the code to a specific IP address by passing it in. Parameter number two is responsible for selecting the port that needs to be opened.

Accessing ports below the magic number 1024 requires root privileges on many Unix systems – simply running the program from the IDE would result in an access error. Avoid this problem by using port number 1025. Finally, the exec() method of QCoreApplication is invoked to start the main event loop.

Debugging and deploying network-related programs can be quite complex. For example, ImagineTCPServer will fail to start if another application is already connected to the port in question.

However, this can be remedied by choosing a different port or by closing the offending application, which can be found via the netstat tool.

Signals and slots

Most network operations run asynchronously. Methods like listen() return immediately, delegating the actual work to a background thread. With QTcpServer, incoming connections are announced by the newConnection signal.

"Signals can only be handled by classes derived from Qobject"

Signals can only be handled by classes derived from Qobject. Click File>New File or Project to open the creation wizard, then Select C++ → C++ Class to start the class generator. ImagineListenerClass.h looks as follows:

```
class ImagineListenerClass : public
QObject
{
    Q_OBJECT
public:
    explicit ImagineListenerClass(QObject
*parent = 0);
public slots:
    void connectionIncoming();
};
```

Slots are implemented via normal member functions. Add the following routine to imaginelistenerclass.cpp:

```
void ImagineListenerClass::connectionIn
coming()
{
    qDebug() << "Client connection
attempt";
}
```

Signal-Slot connections are established via the connect method. It requires pointers to the sending and the receiving objects, the actual signal and slot are to be specified via SIGNAL() and SLOT() macros:

```
else
{
    qDebug()    << myServer-
>serverAddress() << " " << myServer-
>serverPort();
    myListener=new
ImagineListenerClass();
    QObject::connect(myServer,
SIGNAL(newConnection()), myListener,
SLOT(connectionIncoming()));
}
```

Client time

The work on the server is completed, but only for now. Start it up by clicking the Play button

inside Qt Creator and then make sure that you keep your console window open. You can now check its functionality by opening a terminal window and entering **netstat -tlnp**, and the ImagineTCPServer will show up. Open a second session of Qt Creator in order to develop the client. Create another Qt Console Application named ImagineTCPClient and modify its .pro file to enable networking as outlined above.

"At first, using TCP/IP to connect the processes sounds like overkill, but many programs are implemented in this fashion"

Connecting to servers requires the use of a QTcpSocket. Its most basic implementation is made up of but two lines:

```
QTcpSocket *mySocket;
int main(int argc, char *argv[])
{
    QCoreApplication a(argc, argv);
    mySocket=new QTcpSocket();
    mySocket->connectToHost(QHostAddress
::LocalHost, 1025);
    return a.exec();
}
```

ConnectToHost() is another asynchronous method which takes two parameters. The first one designates the IP to use, while the second specifies the port. Successful connections will be indicated by the emission of a signal which we will handle in the next step. For now, a running instance of ImagineTCPServer will display a connection attempted message when our client is started.

At the first glance, using TCP/IP to connect two processes on the same machine sounds like overkill. However, many programs are implemented in this fashion – handling inter-process communication via sockets provides a safe and simple way to de-couple components from one another.

Streams of data

Real network applications exchange data, which is accomplished by using the data streams embedded into the socket instances. First, modify the constructor of ImagineListenerClass to provide the myServer instance to the method responsible for handling the newConnection signal. Then adjust its body as per Fig. 01.

QTcpServer can happily handle multiple pending connections at the same time. NextPendingConnection returns a socket representing the connection to the selected client. We'll wire its disconnected signal to the deleteLater slot to ensure unneeded sockets will be eliminated automatically. In the next step a byte array is populated and sent to the client.

Qt's underlying DataStream class gets improved as the framework evolves. Specifying a data format ensures that binaries built with later versions of Qt can interpret the data provided in the socket. Many applications use Qt 4.0's format. If your program is limited to Qt 5 and above due to other dependencies, you can also define this version as baseline.

The next step involves modifications to the client. Insert a class similar to the ImagineListener to handle the signals emitted from the socket class. Our application has to deal with three events – we need to notify the user of successful and failed connections and must receive data sent from the server.

Status messages are handled by emitting the corresponding statements to the console via qDebug() (see Fig 02).

Receiving data is more complex. Our simple protocol doesn't inform the client in advance about how much data is to be transmitted. Due to that, we simply read whatever amount of data has been received:

```
void ImagineReceiver::dataReady()
{
    QDataStream in(mySocket);
    in.setVersion(QDataStream::Qt_4_0);
    QString thatsIt;
    in >> thatsIt;

    qDebug()  << thatsIt;
}
```

Each of the slots must be connected to the socket. This should be done before the connectToHost method is invoked. On some operating systems the connected signal is emitted before connectToHost returns (Fig. 03). Run the program in its current state to display the greeting message from the server – it will show up in the client's window. ErrorOccurred will be invoked to inform our program that the server terminated its connection.

Further interaction

Our server currently kicks out clients after providing them with a friendly greeting message. A polite server would stick around and wait for a response. Even though we could keep the sockets in our current example, this would lead to issues once more than one client is connected – we connect all signals to one slot which makes keeping the different connections apart difficult.

A thread is a convenient solution for this problem. Threads are subroutines that run in parallel to the main application code – spawning threads permits your code to do multiple things at the same time. Adding a thread is as easy as adding a new class whose header looks like this:

```
class ImagineThread:public QThread
{
    Q_OBJECT
public:
    ImagineThread(QTcpSocket* _aSocket);
    void run();
public:
    QTcpSocket* mySocket;
};
```

The actual payload can be found in the run() method which will be executed in the background after the thread was spawned:

```
void ImagineThread::run()
{
    exec(); //Start event loop
}
void ImagineThread::dataReady()
{
    QDataStream in(mySocket);
    in.setVersion(QDataStream::Qt_4_0);
    QString thatsIt;
    in >> thatsIt;
    qDebug()  << thatsIt;
    exit();
}
```

ImagineThread's sole role involves staying until a signal is emitted. We accomplish that by invoking the exec() method which creates an event loop. It keeps idling until exit is called from the dataReady handler.

Our server must be modified in order to start the thread when a new client connects (Fig. 04).A classic beginner's mistake involves

calling the run() method of a thread directly. Background execution can be accomplished only when start() is called – it invokes the thread-spawning logic and then proceeds to executing the payload.

Finally, change the client so that it sends some data to its master:

```
void ImagineReceiver::dataReady()
{
    . . .

    QDataStream out(&block,
                    QIODevice::WriteOnly);
    out.setVersion(QDataStream::Qt_4_0);
    out << Qstring("Hello, server!");
    mySocket->write(block);
}
```

Multithreaded programs can show all kinds of odd behaviour due to a situation called race condition. If two routines access a shared element at the same time, havoc is guaranteed. Qt provides a variety of methods, such as mutexes, which can mitigate such problems.

Advanced considerations

In the beginnings of the internet, every computer had its own public IP address. Nowadays many, if not most, systems find themselves behind layers of routers providing network address translation and/or firewall services.

The image on page 43 shows a network made up of two local networks connected to one another via the Internet.

If a networked application on system A wants to connect to system B, router B must be configured to expose the port in question. This can usually be accomplished in the backend of the router – since every manufacturer provides a slightly different user interface, it's best to refer to your router's (online) manual.

Conclusion

Well-versed developers can implement the most complex of protocols. Fortunately, Qt provides ready-made classes that implement commonly-used protocols such as HTTP. Next time, we will use one of these to create a small RSS reader.

"Multithreaded programs can behave oddly"

Fig 01

```
void ImagineListenerClass::connectionIncoming()
{
    QTcpSocket *clientConnection = myServer-
>nextPendingConnection();
    connect(clientConnection, SIGNAL(disconnected()),
clientConnection,                       SLOT(deleteLater()));

    QByteArray block;
    QDataStream out(&block, QIODevice::WriteOnly);
    out.setVersion(QDataStream::Qt_4_0);

    out << QString("Hello, client!");

    clientConnection->write(block);
    clientConnection->disconnectFromHost();
}
```

Fig 02

```
void ImagineReceiver::amConnected()
{
    qDebug() << "Connection successful";
}
void ImagineReceiver::errorOccurred(QAbstractSocket::SocketError anError)
{
    qDebug() << "Error: " << anError;
}
```

Fig 03

```
int main(int argc, char *argv[])
{
    QCoreApplication a(argc, argv);
    mySocket=new QTcpSocket();
    ImagineReceiver *myListener=new ImagineReceiver(mySocket);
    mySocket->connect(mySocket, SIGNAL(connected()),myListener,SLOT(amConnected()));
    mySocket->connect(mySocket, SIGNAL(readyRead()),myListener,SLOT(dataReady()));
    mySocket->connect(mySocket, SIGNAL(error(QAbstractSocket::SocketError)),
                myListener,SLOT(errorOccurred(QAbstractSocket::SocketError)));
    mySocket->connectToHost(QHostAddress::LocalHost, 1025);
    return a.exec();
}
```

Fig 04

```
void ImagineListenerClass::connectionIncoming()
{
    QTcpSocket *clientConnection = myServer->nextPendingConnection();
    connect(clientConnection, SIGNAL(disconnected()), clientConnection,
                                    SLOT(deleteLater()));
    clientConnection->setParent(0);
    ImagineThread* myThread=new ImagineThread(clientConnection);
    connect(clientConnection,SIGNAL(readyRead()), myThread,SLOT(dataReady()));
    myThread->start();
    QByteArray block;
    QDataStream out(&block, QIODevice::WriteOnly);
    out.setVersion(QDataStream::Qt_4_0);
    out << QString("Hello, client!");
    clientConnection->write(block);
}
```

Build network clients, servers and more with Netcat

Learn how to use Netcat to accomplish tasks like creating a web server and a chat server

Netcat is a simple but handy UNIX utility that reads and writes data across network connections, using either TCP or UDP. Although it is called Netcat, you can also run it as **nc** – usually, both commands point to the same binary file.

Most of the command line options of Netcat don't need root privileges to operate. Nonetheless, depending on the port number that you want to use when creating a TCP/IP server, you may need administrative privileges to run Netcat because port numbers 0-1024 are restricted, and can only be used by the root user. As a general principle, it is better to avoid these port numbers and choose something else, provided that it is not already in use by another process.

Is Netcat a panacea? Of course not! No single tool can solve every problem. Is Netcat useful? Yes, and that's the main reason that you should learn how to use it.

Resources

Linux machine with Netcat

Root privileges

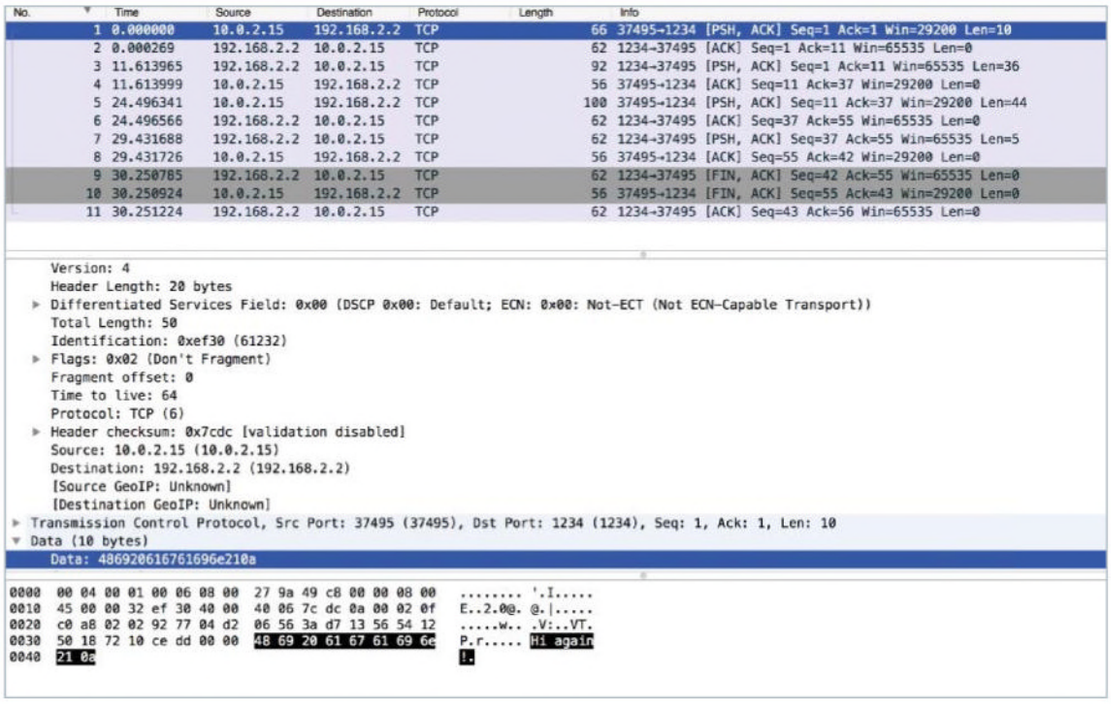
01 Install Netcat

You can easily install Netcat on a Debian system with the following command:

```
# apt-get install netcat-traditional
```

You can also install Netcat using the netcat-openbsd package. The OpenBSD version supports IPv6, proxies and Unix sockets, which are missing from the traditional implementation. In practice, if you don't need these features then you won't notice any difference between the two packages.

Below You can use the tcpdump utility to capture network traffic to or from particular ports



02 Basic Netcat usage

The general form of a Netcat command looks like the following:

```
$ netcat [options] host port
```

The default Netcat behaviour is similar to a simulated network interaction that uses the **telnet** command, which means that the network connection is not secure (ie unencrypted) and that the default protocol is TCP.

If you want, you can also specify a range of ports using the minus character between the two port numbers that indicate the range.

"Default Netcat behaviour is similar to a simulated network interaction"

03 Netcat as a client

The most common Netcat usage is acting as a client for a server process. This is mostly used for troubleshooting network servers because you can see the raw data of the full interaction. The following command will interact with an SMTP server:

```
$ nc linode 25
```

As you can guess, you can give either the host name or the IP address of the remote host.

04 Use files for input and output

According to Unix philosophy, the input to a program can be read from a file and the output can be captured into a file. The input is defined as **<filename** and the output as **>filename**. You can also use Unix pipes to get your input from the output of other processes.

```
mtsouk@mtsouk-VirtualBox:~$ netcat -vv -l 1234
Listening on [0.0.0.0] (family 0, port 1234)
Connection from [127.0.0.1] port 1234 [tcp/*] accepted (family 2, sport 47988)
Hi!
Hello from the server!
mtsouk@mtsouk-VirtualBox:~$
```

05 Netcat as a server

Not only you can use Netcat as a client, you can also use it for creating a server! The next command makes Netcat listen to port number 1234 for incoming TCP connections:

```
$ netcat -l 1234
```

The job is done by the **-l** option because it tells Netcat to listen for incoming connections. The port number is also provided in the command line.

01 Install Netcat

```
cryptcat - A lightweight version netcat extended with twofish encryption
libexpect-perl - Expect.pm - Perl Expect interface
netcat6 - TCP/IP swiss army knife with IPv6 support
netcat - TCP/IP swiss army knife -- transitional package
netcat-traditional - TCP/IP swiss army knife
netcat-openbsd - TCP/IP swiss army knife
netrw - netcat like tool with nice features to transport files over network
netsed - network packet-altering stream editor
socat - multipurpose relay for bidirectional data transfer
root@mail:~# apt-get install netcat-traditional
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  netcat-traditional
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 70.8 kB of archives.
After this operation, 161 kB of additional disk space will be used.
Get:1 http://ftp.us.debian.org/debian/ wheezy/main netcat-traditional amd64 1.10-40 [70.8
kB]
Fetched 70.8 kB in 6s (10.1 kB/s)
Selecting previously unselected package netcat-traditional.
(Reading database ... 124828 files and directories currently installed.)
Unpacking netcat-traditional (from .../netcat-traditional_1.10-40_amd64.deb) ...
Processing triggers for man-db ...
Setting up netcat-traditional (1.10-40) ...
update-alternatives: using /bin/nc.traditional to provide /bin/nc (nc) in auto mode
root@mail:~# which netcat
/bin/netcat
root@mail:~# ls -l /bin/netcat
lrwxrwxrwx 1 root root 24 Feb 26 13:01 /bin/netcat -> /etc/alternatives/netcat
root@mail:~# ls -l /etc/alternatives/netcat*
lrwxrwxrwx 1 root root 19 Feb 26 13:01 /etc/alternatives/netcat -> /bin/nc.traditional
lrwxrwxrwx 1 root root 39 Feb 26 13:01 /etc/alternatives/netcat.1.gz -> /usr/share/man/man
1/nc.traditional.1.gz
root@mail:~# ls -l /etc/alternatives/nc*
lrwxrwxrwx 1 root root 19 Feb 26 13:01 /etc/alternatives/nc -> /bin/nc.traditional
lrwxrwxrwx 1 root root 39 Feb 26 13:01 /etc/alternatives/nc.1.gz -> /usr/share/man/man1/nc
.traditional.1.gz
root@mail:~#
```

06 The UDP protocol

By default, all Netcat interactions work with the TCP protocol. However, it's also possible to use the UDP protocol that is specified with the use of the **-u** option. This is particularly valuable because Telnet can only test TCP services. The following command tries to test a DNS server that uses UDP:

```
$ netcat -vv -u 8.8.8.8 53
```

You can create a UDP server if you combine the **-l** option with the **-u** option.

```
mtsouk@mtsouk-VirtualBox:~$ netcat -z -v -n 192.168.2.1 20-40
netcat: connect to 192.168.2.1 port 20 (tcp) failed: Connection refused
netcat: connect to 192.168.2.1 port 21 (tcp) failed: Connection refused
Connection to 192.168.2.1 22 port [tcp/*] succeeded!
netcat: connect to 192.168.2.1 port 23 (tcp) failed: Connection refused
netcat: connect to 192.168.2.1 port 24 (tcp) failed: Connection refused
netcat: connect to 192.168.2.1 port 25 (tcp) failed: Connection refused
netcat: connect to 192.168.2.1 port 26 (tcp) failed: Connection refused
```

07 Use Netcat for port scanning

Netcat can be used for port scanning as a naive version of Nmap. The next command scans the 192.168.2.1 IP address using a range of port numbers from 20 to 40:

```
$ netcat -z -v -n 192.168.2.1 20-40
```

The **-z** option tells Netcat to send zero data. In other words, Netcat closes the connection as soon as it opens it, without any actual data exchange taking place. The **-n** option tells Netcat to disable DNS lookup for the given IP address.

Above You can see details on the Netcat package right at the top of this output

Finding the problem

As you already know, there are many tools that can be used for network troubleshooting, including netstat, traceroute, wget, ping, lost, nmap, telnet, etc. If you cannot find and solve the problem you are experiencing using this software, you should always have in mind that an erroneous network device can sometimes cause strange networking problems, so you might need to start looking at your hardware instead.

08 File transfer

Netcat can also do things that other similar utilities can't do at all. One of those rare things is file transferring. First, you should start the server part as follows:

```
$ cat fileToTransfer | nc -l 4567
```

Next, get the file using the subsequent Netcat command:

```
$ nc localhost 4567 > fileToTransfer
```

As you can see, you should choose the file that you want to transfer in advance.

"Firewalls and routers can make Netcat misbehave when used for creating a server"

09 Make any process a server

Netcat enables you to make any process a server with the **-e** parameter. Let's now make /bin/bash a server process; the server part should start as follows:

```
$ nc.traditional -vv -l -p 12345 -e /bin/bash
```

The client part should start as follows:

```
$ nc -vv <remote_host> 12345
```

After the last command, you can start executing commands as if you were working on the remote machine. Note that this capability of Netcat can introduce security threats when used improperly, so be very careful with it.



10 Use Netcat as a simple web server

Let's say that you want to serve a simple HTML page from your machine that has the 192.168.2.4 IP address, but you are not able to run a web server. This part will show how to serve it using Netcat without the need for a web server. First, you will need to create a simple HTML file called index.html. Then you will need to start a Netcat server as follows:

```
$ netcat -l 4567
```

If you visit http://192.168.2.4:4567/ using your web browser, you will see index.html.

11 Verbose output

Netcat can generate richer output to help you when troubleshooting. You should use the **-v** command line parameter to make Netcat give more verbose output. Using **-vv** instead of just **-v** gives a larger amount of verbose output, which is very useful.



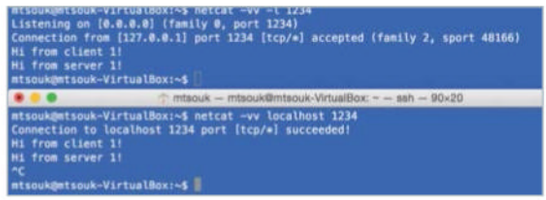
12 Troubleshoot a web server

The HTTP service is just a TCP service, so Netcat can be used to get data from a web server. This command initiates a connection to a web server:

```
$ netcat www.linuxuser.co.uk 80
```

In order to get some output, you should first type in **GET / HTTP/1.1** and then press Enter two or three times to start seeing the information. Alternatively, you can always use the following single-line method, which doesn't require any additional typing from you:

```
$ echo -en "GET / HTTP/1.0\n\n\n" | netcat www.
  linuxuser.co.uk 80
```



13 Create a chat server with Netcat

You can get two users from the same or different machines talking to each other by creating a chat server. You should start the server part as follows:

```
$ netcat -vv -l 1234
```

Each client that wants to connect to the server must execute the following command:

```
$ netcat -vv localhost 1234
```

Only two machines can participate at the same time: the server and only one client. If a second client tries to connect while another one is already connected, the following error message will appear to the second client:

```
netcat: connect to localhost port 1234 (tcp)
failed: Connection refused
```

Picking your tools

Knowing more than one tool is extremely useful when a network is misbehaving. The ultimate troubleshooting tool is Wireshark and its command line version tshark. Their disadvantages are that they are not easy to use, and will sometimes make you feel like you're trying to hit a mosquito with a nuclear bomb. The best practice is to try the simplest tool that can do your job first, before heading over to Wireshark, tshark or tcpdump.

14 Test network speed using Netcat

This is a relatively tricky use of Netcat, but it is very handy when you don't have any other tool to test the network speed between two machines. For this to work you'll have to use the netcat-traditional package.

Now, on the server machine you will need to execute the following command:

```
$ time nc -D -vv -n -l 2222 >/dev/null
```

On the client machine, execute the next command and press Ctrl+C after about 15 seconds to make it stop:

```
$ time yes | nc.traditional -vv -n 192.168.2.4
  2222 >/dev/null
```

Using the **bc** utility, you can find out that the network speed is about 1,108,087 bytes per second, which is absolutely perfect for a 10MB wireless network.

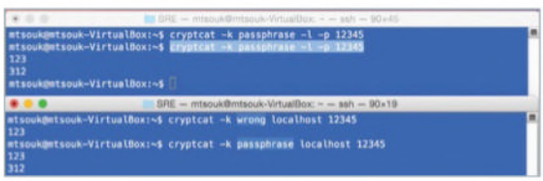
15 Transfer entire directories using Netcat

You have already learned how to transfer single files using Netcat. Now, you are going to learn how to transfer whole directories using Netcat and the help of the **tar** command. The server part is the following:

```
$ tar -cvf - directory | nc -l 1234
```

The client part should be as follows:

```
$ nc localhost 1234 | tar -xvf -
```



16 Encrypt a Netcat connection using Cryptcat

Transferring data in plain text isn't secure and may cause problems. If you need encryption, use Cryptcat, a lightweight version of Netcat that includes Twofish encryption. On an Ubuntu system, install as follows:

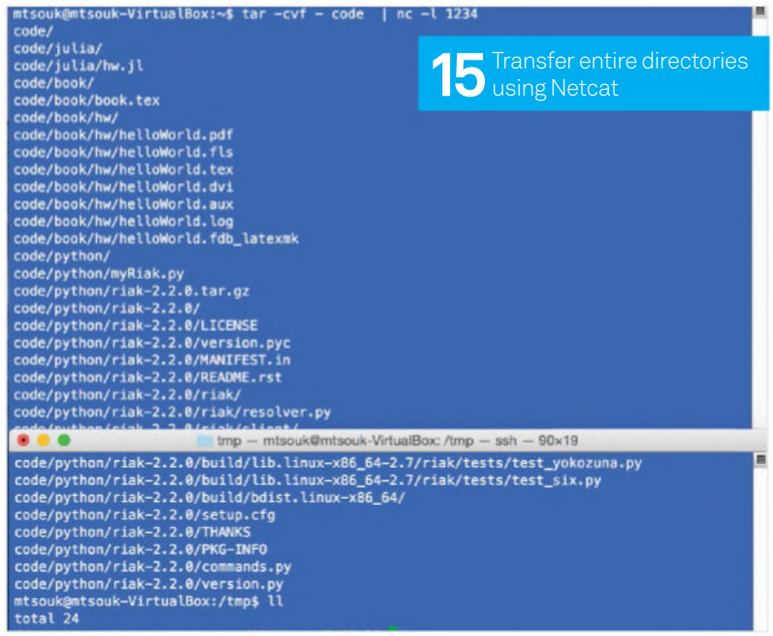
```
$ sudo apt-get install cryptcat
```

Now, you are ready to start using Cryptcat. The server part looks like this:

```
$ cryptcat -k passphrase -l -p 12345
```

The client part should run the following command:

```
$ cryptcat -k passphrase localhost 12345
```



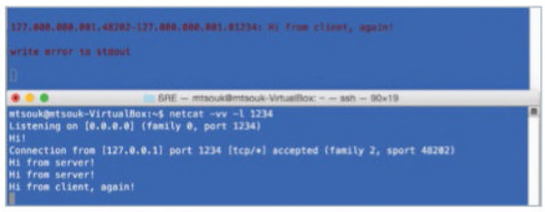
15 Transfer entire directories using Netcat

If you give a wrong password after the **-k** parameters, the connection will automatically terminate. If you want to make sure that your data is actually encrypted, you can use a tool such as Wireshark or Tcpdump to sniff it and see the results.

Above You don't need Dropbox to transfer folders over your network

17 Firewall and router issues

Firewalls and routers can make Netcat misbehave when used for creating a server with the **-l** parameter. Difficulty lies in the fact that a router or a firewall may not enable hairpin connections. The router or the firewall would not make the connection when both the source and destination are behind the NAT. As a result, the machine won't listen to the specified port, using an arbitrary port instead.



18 Capture network data using tcpflow

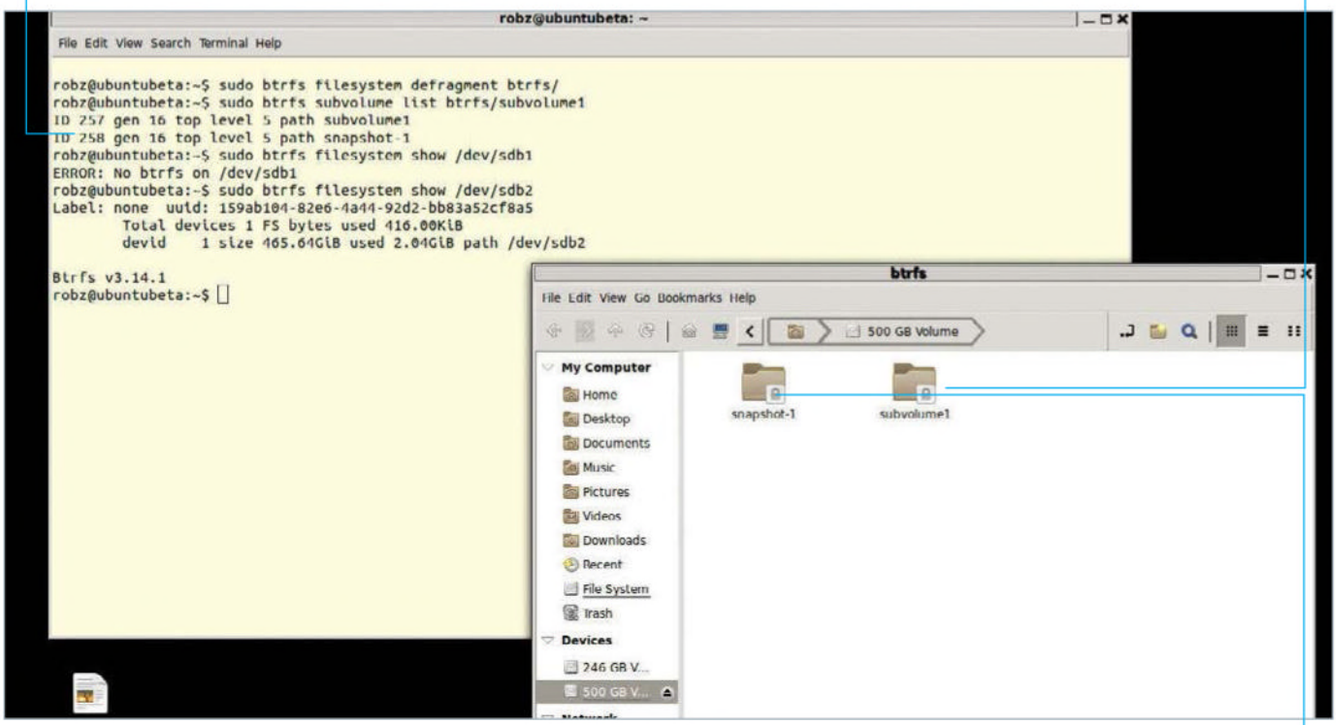
If lots is happening and you can't find out where the actual problem is, ask Tcpflow, Tcpdump and Wireshark for help. Tcpflow is a command line tool to help you inspect network data. The following command displays network data from or to port number 1234:

```
$ sudo tcpflow -i any -c -J port 1234
```

If you cannot solve your problems with tcpflow, capture your data with tcpdump and process it with Wireshark.

Create multiple types of btrfs file systems, from single hard drives to RAID 10 arrays

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Switch to the btrfs file system

Discover how to set up and use all the great features of the next generation of file system, btrfs

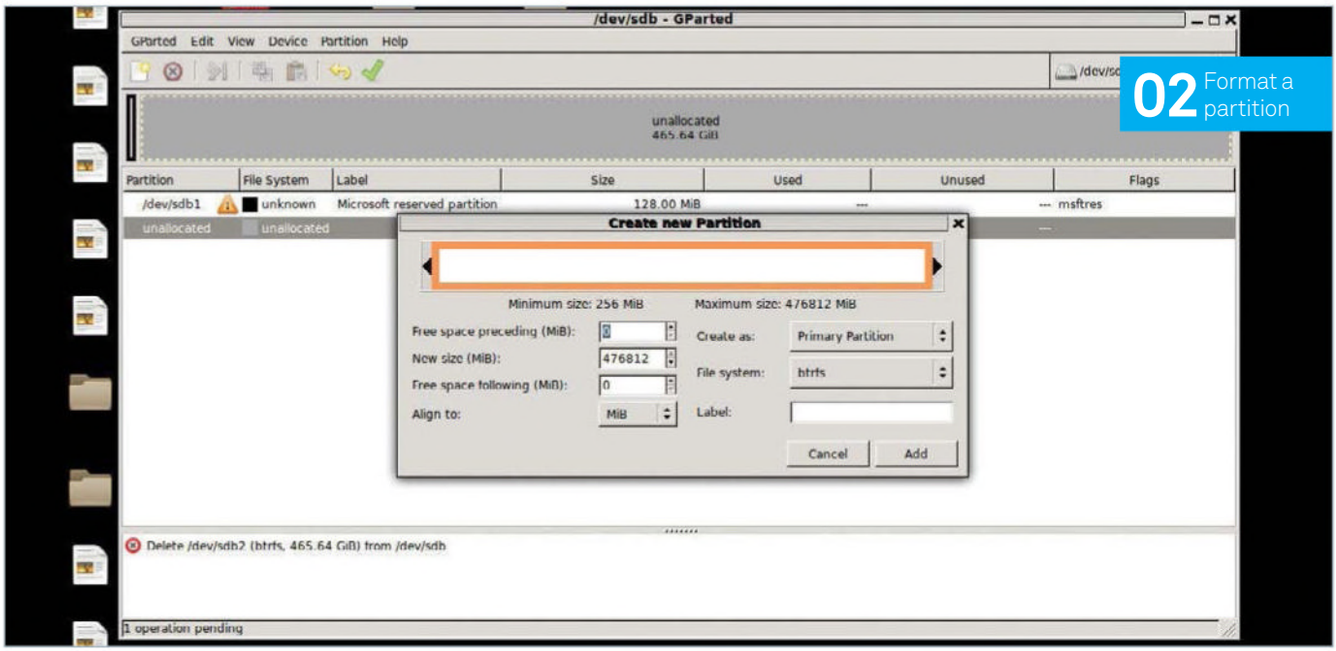
Resources

Gparted http://gparted.org
btrfs-tools

The ext3 and ext4 file systems have been a mainstay of Linux for a long time – very standard, partition-based file systems that have some neat defragmentation policies. They're used all the time by desktop distros and servers and such, even within LVMs that some distributions like to create.

There's always a new challenger though, and for the past few years Fedora has been desperately trying to get btrfs in as the default file system of the distro. It's considered the next step in Linux file systems and has some excellent features that should make it a perfect choice for the evolution of Linux.

With the ability to create sub-partitions within itself that are easier to manage than LVM, a degree of roll-back, advanced compression and defragmentation tools tailored to itself and more, btrfs will revolutionise the way we use storage. We'll show you how you can get ahead of the curve in this tutorial.



02 Format a partition



"Don't forget, you can always check the details of your btrfs partitions and hard drives"

01 Find the right tools

The very first step is to install the appropriate setup tools. While it's supported in the kernel, not every distro holds the right packages to manage it by default. In Debian and Ubuntu distros, install it with:

```
$ sudo apt-get install btrfs-tools
```

02 Format a partition

Now the tools are installed, you can set up your btrfs partition on your system using gparted if you want. Launch it and navigate to the device that you want to format. You can either reformat existing partitions or make a smaller btrfs partition instead.

03 Go into the terminal

You can also do this in a terminal now the tools are installed. Open it up and use **fdisk -l** if you need to figure out the names of partitions and hard drives on your system. Once that's done, create your btrfs partition with:

```
$ mkfs.btrfs /dev/sda
```

04 Create a RAID

One of the best uses for btrfs, due to the way it stores data, is using a similar technique to put a series of hard drives into RAID 0. For now, do it in the terminal with:

```
$ mkfs.btrfs /dev/sdb /dev/sdc /
```

05 Grab your file system details

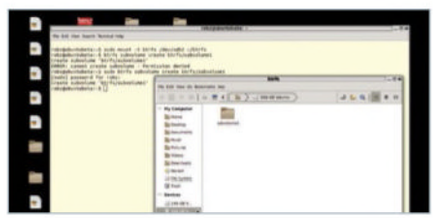
Just in case you've forgotten, you can always check the details of your btrfs partitions and hard drives. This also works with individual hard drives in an array, which is why we mentioned RAID in the previous step. In a terminal, use:

```
$ btrfs file system show /dev/sda
```

06 Mount the file system

With most modern distros you can easily mount the btrfs system with a click. However, to do it manually and place it within a specific section of your file system you can do it simply in the terminal with something like:

```
$ mount -t btrfs /dev/sdb ~/btrfs
```



07 Make a subvolume

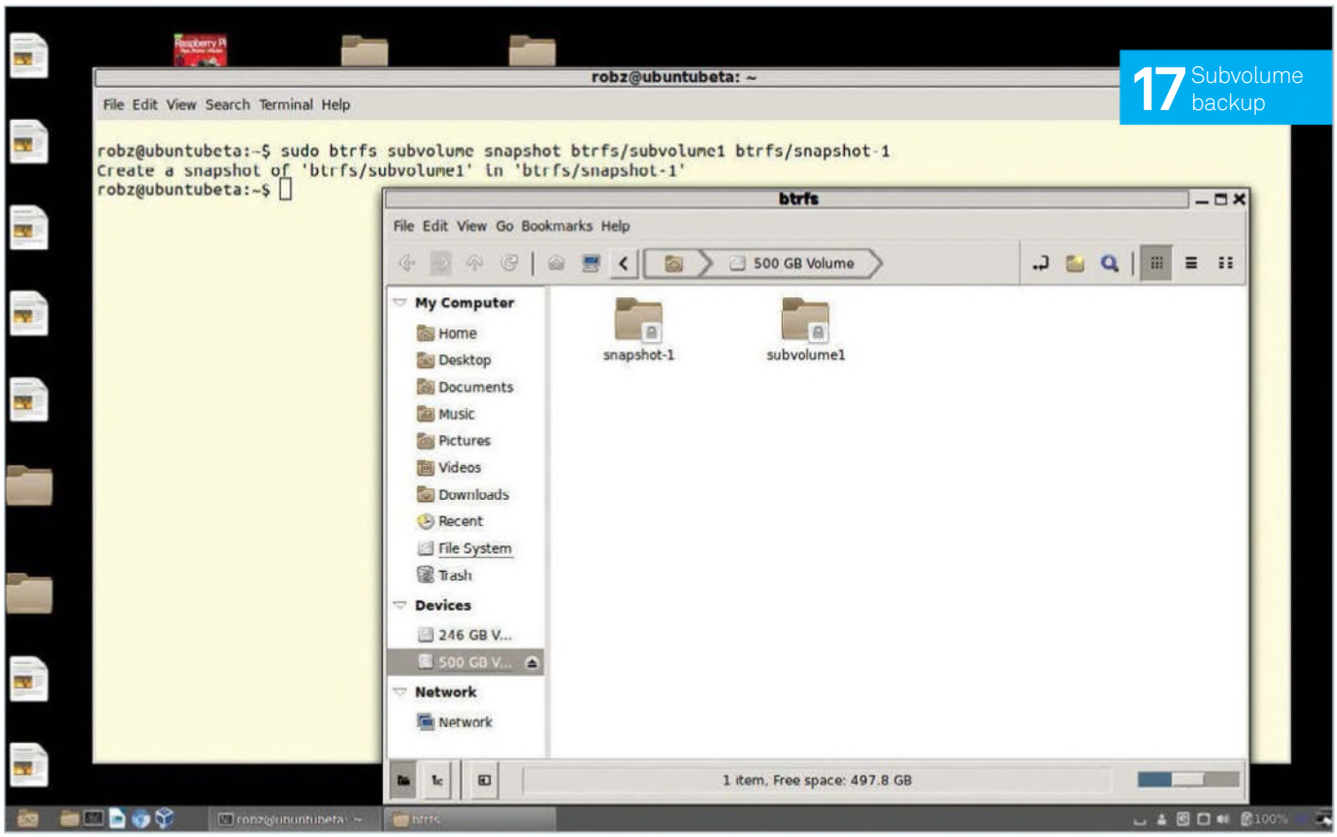
You can create subvolumes within btrfs that can have different mount options and mount points, and only uses space when they need it. Create one in the terminal using:

```
$ btrfs subvolume create btrfs/subvolume1
```

08 Create a partition

We've created hard drives, small RAIDs and subvolumes, but you can also create btrfs partitions using a similar method as before. Convert a partition into btrfs by going into the terminal and using something like:

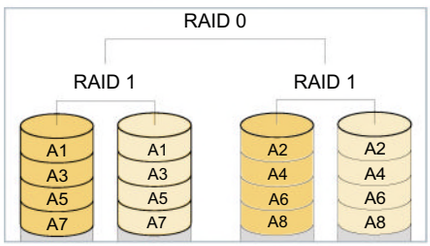
```
$ mkfs.btrfs single /dev/sdb2
```



09 Give permission

The way the drives, partitions and sub-volumes have been created means you need to access them with a root account to use them properly. We can give them normal permissions with the following:

```
$ sudo chown 777 btrfs/
```



10 The RAID

You can use btrfs to create different types of RAID setups – by default it will do RAID 0, but it also supports RAID 1, RAID 10 (1+0), RAID 5 and RAID 6. Choosing which RAID to use comes down to personal preference and how much effort you put in to maintain your setup.

"If you're doing a hardware RAID, having the metadata be redundant may be useful"

11 RAID 1

RAID 1, where data is duplicated across drives for redundancy, can be created on btrfs using a modified version of the command used to create btrfs over a selection of drives. The **-d** option refers to how the data will be used.

```
$ mkfs.btrfs -d raid1 /dev/sdb /dev/sdc
```

12 Have non-redundant metadata

If you're doing a hardware RAID, having the metadata be redundant may be useful – otherwise you can lose your data if the metadata gets corrupted. This requires the **-m** option and can be used on a single hard drive with 'single' or RAID 0 with:

```
$ mkfs.btrfs -m raid0 /dev/sdb /dev/sdc /
```

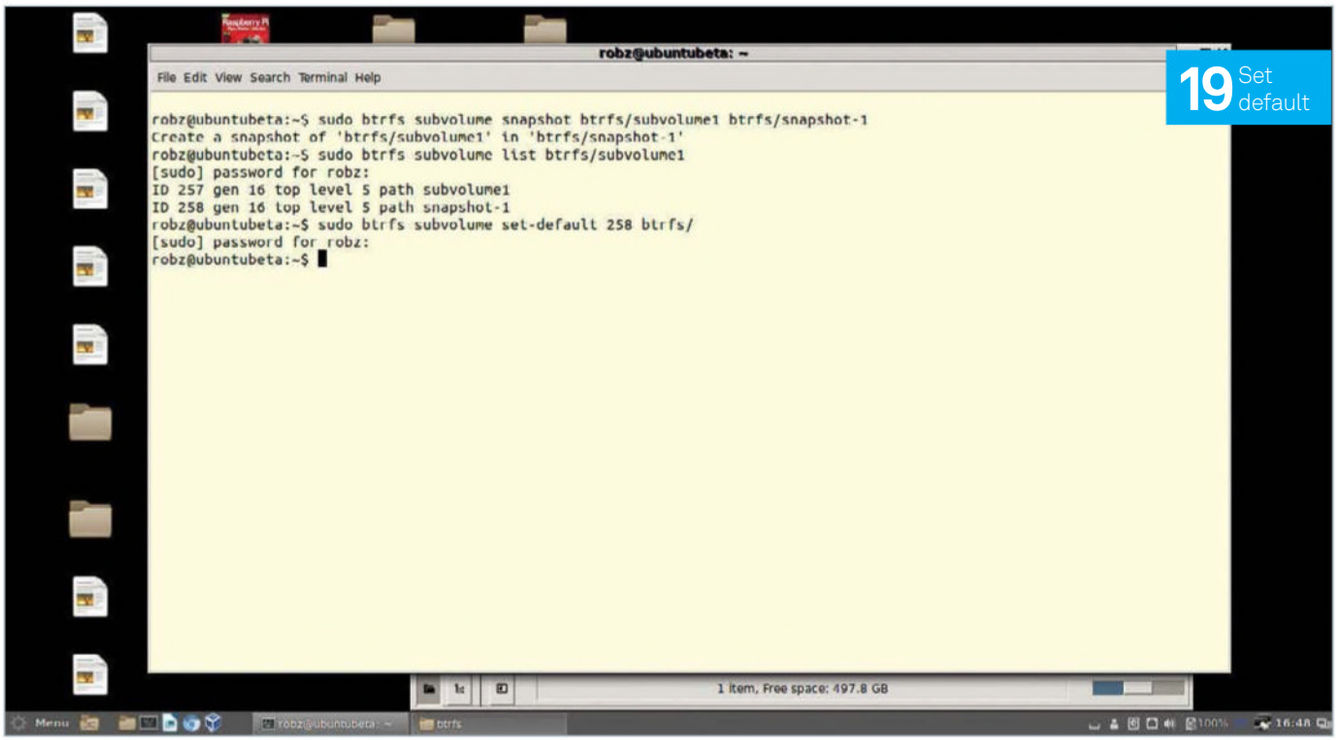
13 RAID 10

Basic mirroring and striping with RAID 10 is good for large data repositories and redundancies. We can use both options **-m** and **-d** to specify that we want metadata and data to be properly made redundant with:

```
$ mkfs.btrfs -m raid10 -d raid10/dev/sdb
/dev/sdc /dev/sdd /dev/sde
```

14 Look at the different options

The options for **-m** and **-d** allow you to do some fancy setups. You can create a btrfs JBOD (Just a Bunch Of Drives) by doing **-d single /dev/sdb /dev/sdc**. You can also have metadata be non-redundant while data is redundant with **-m raid0 -d raid1 /dev/sdb /dev/sdc /dev/sdd.** There are many more ways to do it as you see fit.



15 RAID 5 and 6

RAID 5 and RAID 6 are excellent concepts – using a mixture of striping and mirroring across several drives so that up to 75 per cent can be used for storage while still being safe from hard drive failure. This offers more storage than a standard RAID 10 with the same redundancies (in theory), and RAID 6 increases the redundancy but decreases the overall storage of five drives to 60 per cent of their full capacity.

While it's supported in btrfs there are still bugs, and even at the best of times 5 and 6 can be a hassle. For more details on RAID 5 and 6 in btrfs, visit the documentation **https://btrfs.wiki.kernel.org/index.php/RAID56.**

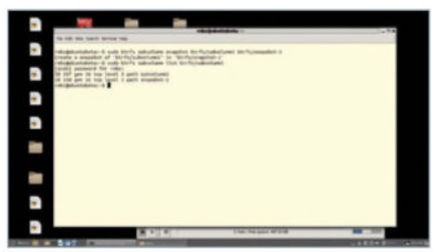
16 Create snapshots

The way btrfs writes data means that the old version of modified data still exists as long as there's free space – this means you can 'roll back' files up to a certain point. However, you can also create snapshots of subvolumes that are more permanent.

17 Add a subvolume backup

To create this snapshot, head back into the terminal and make sure you know where the subvolume lies. The snapshot will be created in the btrfs partition, but it is best to put it in a separate location to the original subvolume1 to save confusion:

```
$ btrfs subvolume snapshot btrfs/
subvolume1 btrfs/snapshot-1
```



18 Include a roll back snapshot

The individual snapshots can be mounted on their own and you can also replace a newer version with an older version. First of all you will need to list the snapshots that exist for a subvolume, and you can do this in the terminal with:

```
$ btrfs subvolume list btrfs/subvolume1
```

19 Set default

Note down the id for the snapshot (in our case, 258) and then set it as the default for the subvolume1 by using:

```
$ btrfs subvolume set-default 258 btrfs/
```

Then unmount and remount the subvolume to make the changes occur.



20 Remedy defragmentation

Due to the way btrfs writes files, which we outlined in an earlier step, this can cause significant fragmentation. This is a well-known issue though, so btrfs has an in-built defragmentation tool that works even while the volume is mounted. You can use it with:

```
$ btrfs file system defragment btrfs/
```

21 The future file system

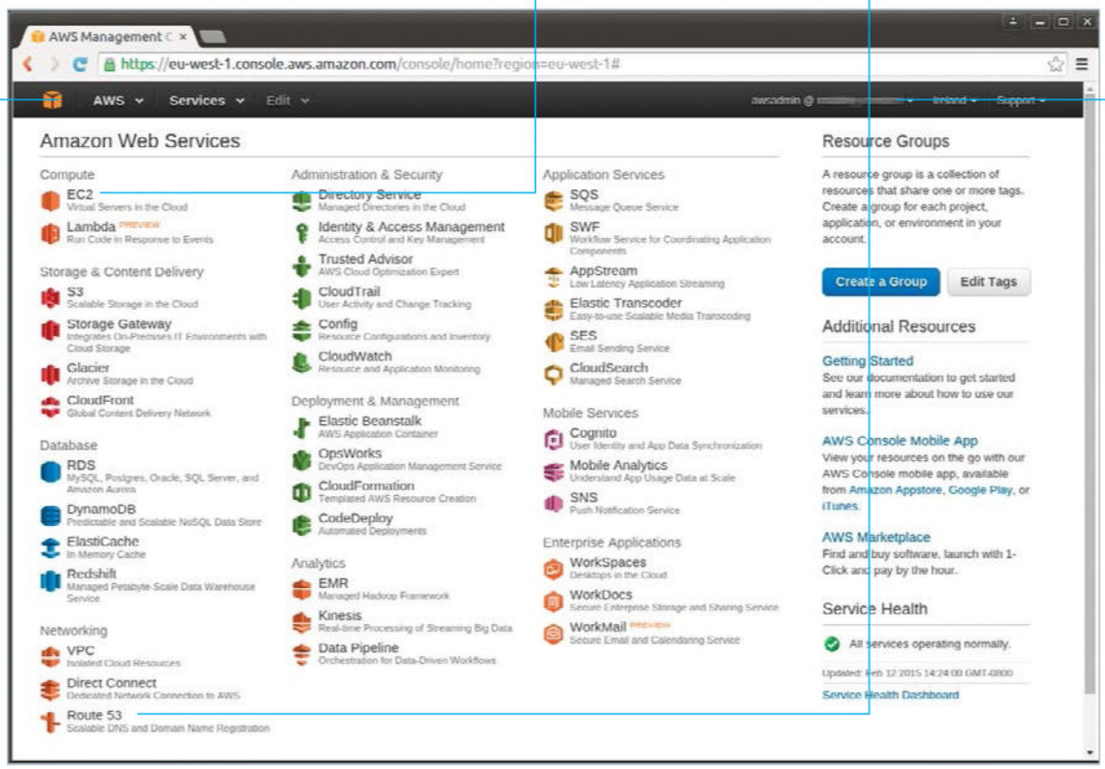
With all these tools you should be well on your way to working with btrfs as a replacement for your other file systems. It is a truly excellent concept for the next generations of fs and it's a great idea to get on board with it now.

The AWS logo in the AWS Management Console shows the infrastructure services

If you want to run your own Linux box in the cloud, look no further than EC2

Reserve domain names and DNS route to your Linux server in the cloud with Route 53

Go to your cost management services and billing information via a menu with your username



Run Linux in the AWS cloud

Power up your own virtual Linux instance on EC2 and run it free for a year

AWS, short for Amazon Web Services, is the equivalent of an online retailer for virtual infrastructure and cloud services, complete with an automated self-service checkout and rock-bottom prices. Amazon's pay-as-you-go rendition of enterprise-class infrastructure services is welcomed by cost-conscious, performance-hungry users – from website owners who need to scale out on demand, to software developers and Linux administrators who only need a Linux box for a few hours. On AWS, there are no long-term commitments – you only pay for actual use.

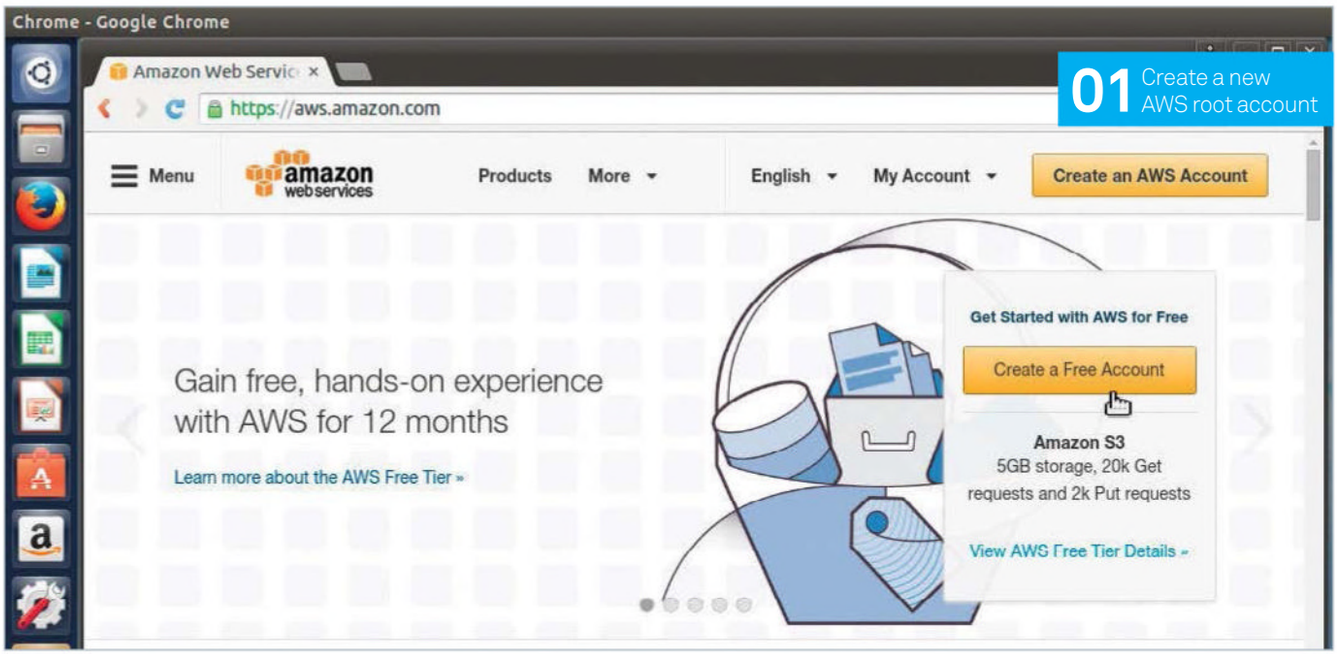
With cost savings of as much as 72 per cent and more over a conventional data centre, it is no wonder that AWS quickly became the hot ticket in town. The research firm Gartner estimates the total global market share of AWS at a mind-bending 83 per cent. Arguably, the most important feature of Amazon's cloud is not its sheer size but its affordability.

Amazon gives each new account owner a Free Usage Tier for a full year after they first register: **https://aws.amazon.com/free**.

So, thanks to its low prices, no up-front investment, its granular administrative controls and the freedom to run your own infrastructure in your own way, AWS has turned into an open source stronghold where Linux reigns supreme.

Resources

Web browser
Phone number
Email address
Credit card number
SSH client
(optional but recommended)



01 Create a new AWS root account

To get started with AWS, navigate to **https://aws.amazon.com** in a web browser and click on 'Create a Free Account'. At this point you could sign in with your existing Amazon credentials but this isn't always a good idea. Should you ever need to terminate your AWS account, you would also lose access to your account with Amazon, the online retailer. For this reason, most users prefer to register with another email address just to be safe, in case anything happens in the future.

02 Complete the registration process

During registration, AWS will ask you to provide your contact details including an email address, your phone number and a credit card number. Amazon will then verify that you are human via an automated phone call. Your credit card number serves to confirm your identity as the payer and Amazon will keep it on file. As long as you only use services that are within your Free Tier capacity allotment, your card will not be charged at any point.

The registration process creates an AWS root account, which grants you access to all AWS infrastructure services. It has nothing to do with a root account on a Linux system, even though the underlying concept is very similar.

Never use your AWS root credentials for administrative work on your account except during your initial sign-in in the next step.

03 Sign in to your AWS root account

The browser-based administrative interface on Amazon – the AWS Management Console – is the main switchboard for your AWS infrastructure and services. You can access it at **https://aws.amazon.com** from the pull-down menu called My Account or directly at this URL: **https://console.aws.amazon.com**. In either case, use the credentials of your AWS root account (your email address and your AWS root password). Make sure you never do this on a public network or public computer because if your credentials were intercepted, you could lose access to your entire infrastructure while still footing the bill. For this reason, Amazon recommends that after the initial sign-in, you immediately create a less privileged IAM user for your daily interactions with AWS and link it to an MFA device for multifactor authentication (which is a topic for another tutorial altogether).

04 Navigate the AWS Management Console

Quite predictably, the Console is peppered with AWS lingo so pervasive that even the toughest occasionally shake their heads in disbelief. To fire up a Linux box in the AWS cloud, you want to navigate to EC2 (Elastic Compute Cloud). For DNS services and domain name registration, head towards Route 53. If all you need is some storage that should remain easily accessible, you don't actually need a Linux box – instead, go straight to the S3 (Simple Storage Service) section of the Console. The simplest way to get to your destination is by using the AWS logo in the upper left-hand corner of the Console, as this gives you access to the list of available services.

Private, public and elastic IPs

Each EC2 instance has its own private IP (Internet Protocol). If you want this to be accessible from the wider Internet, it also needs to have an assigned public IP. If you enable the option named 'Auto-assign Public IP' during the instance setup, Amazon will associate a randomly selected public IP to your instance for as long as the instance keeps on running. Should you later terminate the instance or even shut down Linux, you would automatically lose use of this IP.

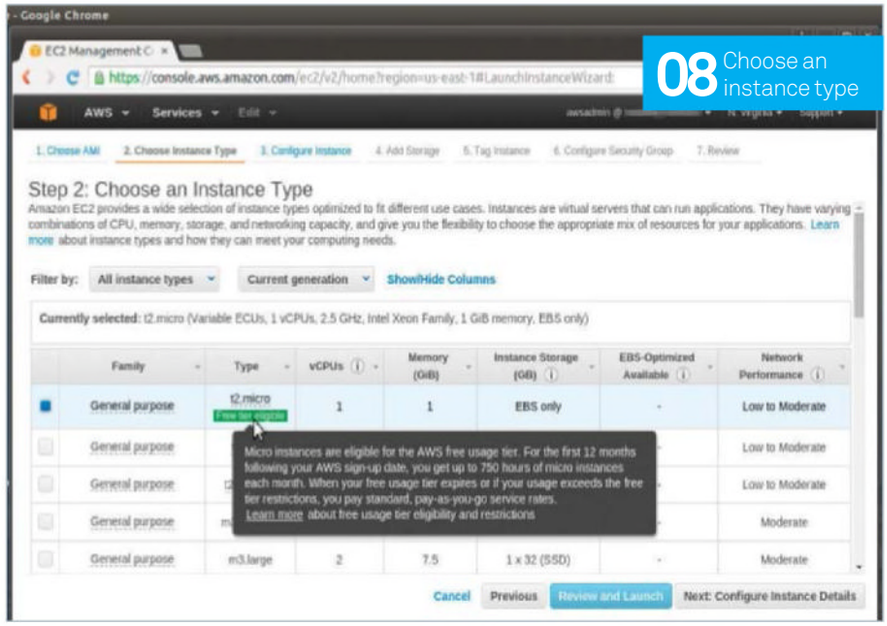
If you prefer to use a persistent IP address that you can manage yourself, use an 'Elastic' IP address here (EIP) instead. An EIP is designed for dynamic cloud computing, and is a regular public IP address that you can reserve for use with your account, then assign and reassign at will.

EBS Volumes

EBS volumes are slower than instance storage but offer data persistence – you can attach and detach them even while your Linux instance is running.

EBS volumes come in two different flavours: as magnetic hard drives or 'flashy' SSDs. Amazon offers SSDs in one performance category – General Purpose or Provisioned IOPS, which deliver bursts of I/O depending on the size of the drive and other users' activities within the shared storage pool.

SSDs with provisioned IOPS will perform at the specified I/O level, but they can certainly be pricey. General Purpose SSDs are more likely the way to go for the wallet-conscious. If you're budgeting and only need infrequent access, Magnetic is an adequate compromise.



05 Choose your AWS region

Some AWS services, particularly EC2, require you to select an AWS region. A region is a set of interconnected data centres, called AWS zones, with a common tax jurisdiction and identical pricing. You can utilise services in any of the nine AWS regions, not just your default one, and combine them to suit you. Typically, you would pick the most cost-effective one or combine several regions that are closest to the location of your end users to minimise latency. It's important to remember that your EC2 dashboard shows infrastructure that you are paying for only in the region currently selected. This is a common trick of AWS: watching resource consumption in the dashboard of a wrong region, so beware.

06 Launch a new EC2 instance

Navigate to the EC2 section of the AWS Management Console. This part of the interface grants you access to a variety of infrastructure services which enable you to build and run your own Linux box in the AWS cloud, a so-called EC2 instance of Linux.

Each EC2 instance represents a host that runs in a virtualised environment in isolation from other virtual machines, which makes it very cost-effective and reasonably safe. In order to start your own Linux server in the cloud, click on Launch Instance in the EC2 Dashboard. You can also click on the link Instance in the left-hand navigation pane of the AWS Management Console and then on the button Launch Instance.

07 Select a Linux-based AMI

The storage configuration of an instance is described using a machine definition called an AMI (Amazon Machine Image). An AMI specifies, among other things, the contents of the boot volume. Select an AMI based on a Linux distribution of your choice from the list in section Quick Start (not a database instance, an Amazon RDS instance doesn't grant you superuser access at the OS level). Instances labelled 'Free tier eligible' do not incur any costs so long as you remain within the time allotment of up to 720 hours per month throughout the first 12 months after your account is first registered.

08 Choose an instance type

The instance type defines the performance characteristics of your Linux box in terms of its clock speed, available RAM, internal storage and network capabilities. The only instance type that qualifies for the free usage tier is t2.micro.

Make your choice and then click 'Next: Configure Instance Details'.

09 Configure instance details

On the next screen, you can select how many instances to start, whether you want them to be persistent (leave the Purchasing option check box deactivated), if they should have their own privileges to access your AWS services (IAM role>None), and configure networking. It is best to launch an EC2 instance in a virtual private cloud (VPC), which is a fancy way of saying that Amazon will isolate it from other users' instances by means of smart routing. Older AWS accounts may also offer an option labelled 'EC2-Classic', which does not have this protection, so if you see it, don't use it.

In the menu 'Auto-assign Public IP', select 'Use subnet setting (Disable)'. Set the IAM role to None and shutdown behaviour to Stop.

If you enable 'Termination protection', AWS won't let you destroy the instance using the Terminate command in the Console until you remove this protection.

Leave the other options unchanged and click on 'Next: Add Storage'.

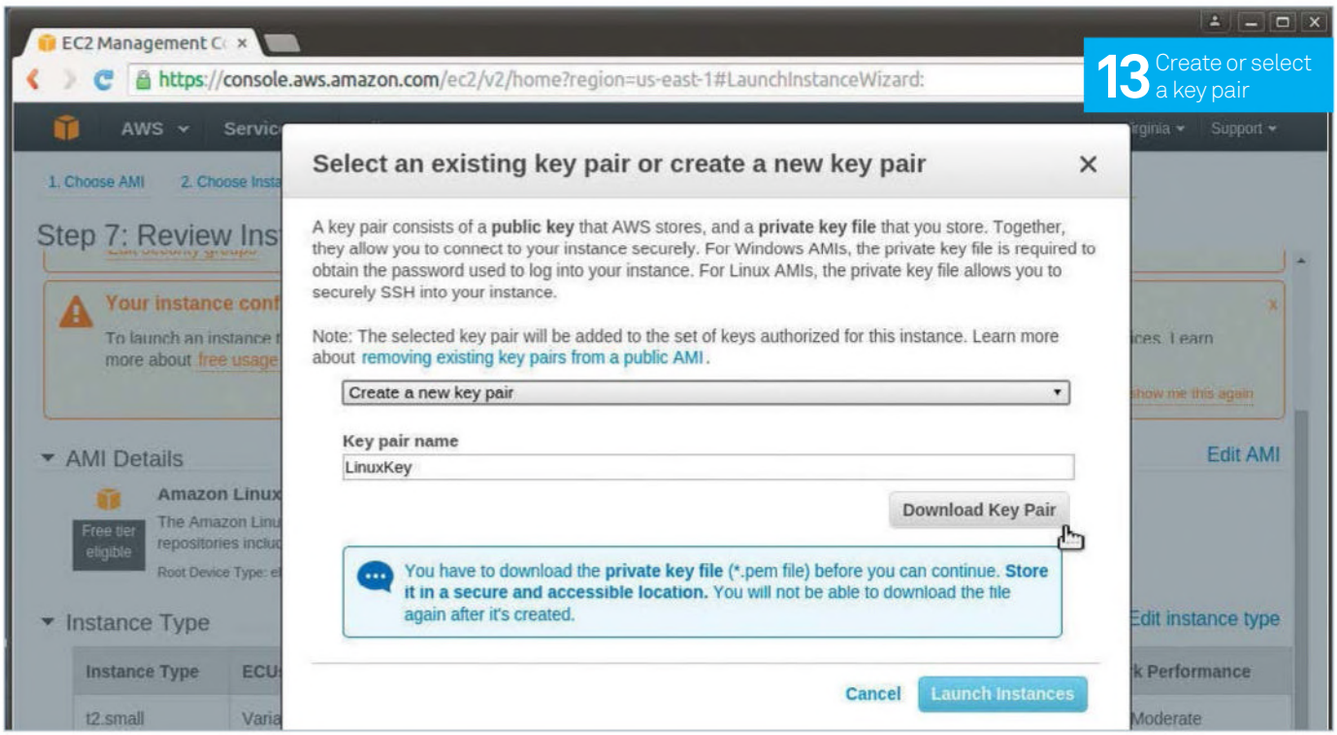
10 Attach storage

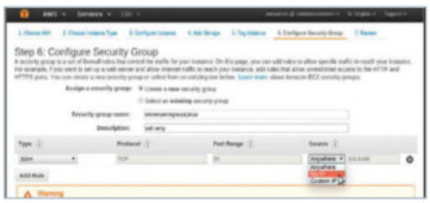
If you need additional volumes, you can create and attach them now. Free Tier covers up to 30GB of General Purpose (SSD) storage giving you a maximum baseline performance of slightly under 100 IOPS (see 'EBS Volumes' boxout for more information).

Now click on 'Next: Tag Instance'.

11 Tag your Linux Instance

Tags on AWS are key value pairs that store information that can help you to organise your AWS resources. Using tags is purely optional. Don't sweat it – you can always edit tags later if you need to. If nothing comes to mind, click on Next>Configure Security Groups.





12 Configure security groups

Think of Security Groups as settings for an AWS firewall that specify 'Enable rules for inbound and outbound traffic'. For each Linux instance, you need to enable ingress access (inbound traffic) on TCP port 22 for SSH from at least one IP address (yours). Unless you are on a static IP (or an IP range), you may have to enable access from anywhere. If you need other services, add the corresponding rules (eg open port 80 for HTTP and 443 for HTTPS if you want to run a web server). Then click 'Review and Launch'.

13 Create or select a key pair

Verify your settings and hit Launch. The wizard will ask you to create or select a key.

Passwords are out, key pairs are in. A private key is what authenticates you as the administrator of your Linux instance. SSH will attempt to verify the authenticity of your private key, based on a copy of a corresponding public key that AWS is about to save in the appropriate location of the Linux system on your instance.

You could generate your key pair yourself and upload the public key to the EC2 console, or you can ask Amazon to create a key pair for you, which is faster. Select 'Create a new key pair', give it a name, download the private key to your computer and correct access privileges on it:

```
chmod 400 /path/to/yourPrivateKey.pem
```

Once this is done, you can launch your instance. It will show up in the section Instances of the AWS Management Console for EC2.

14 Assign an EIP to your EC2 instance

Unless you chose to auto-assign a public IP to your instance, it does not have a Public DNS entry yet and is inaccessible from the outside. Click on the link Elastic IPs in the left-hand navigation pane of the EC2 console. Here you need to obtain a new elastic IP address for your AWS account (Allocate New Address) and associate it with your instance (Associate Address).

15 Connect to your Linux instance

Wait until your instance passes both health checks and reports its state as 'running'. You should be able to connect to it using any stand-alone SSH client or the Java-based client that Amazon provides. Navigate to the Instances section of the Console, select your instance from the list and click on the Connect button to view instructions. Start an SSH client and enter this:

```
ssh -i /path/to/yourPrivateKey.pem
username@XX.XX.XXX.XX
```

The username is usually either ec2user or root, but technically the creator of the AMI can set it to whatever they want. If your initial username is anything other than root, you can assume superuser privileges using the command:

```
sudo su
```

If you attached any additional volumes to your instance (besides the volumes that came with the AMI), now is the time to format them, mount them and add them to /etc/fstab.

"Passwords are out and key pairs are in"

TRICKS

Put Linux to work with expert tricks

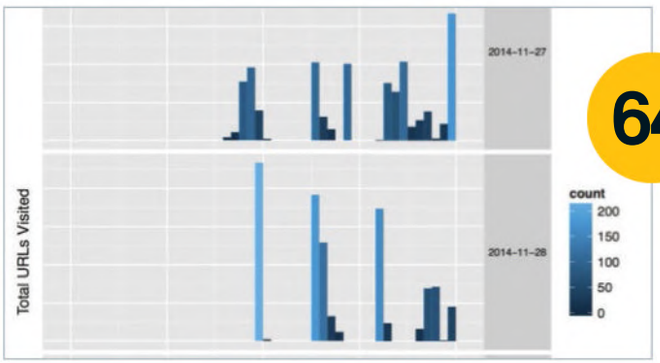
60 Continuously deploy web apps
Transition to deployment with Capistrano

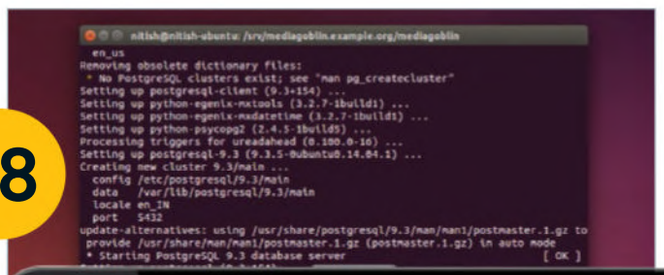
64 Generate complex graphics in ggplot2
Create impressive plots with R and ggplot2

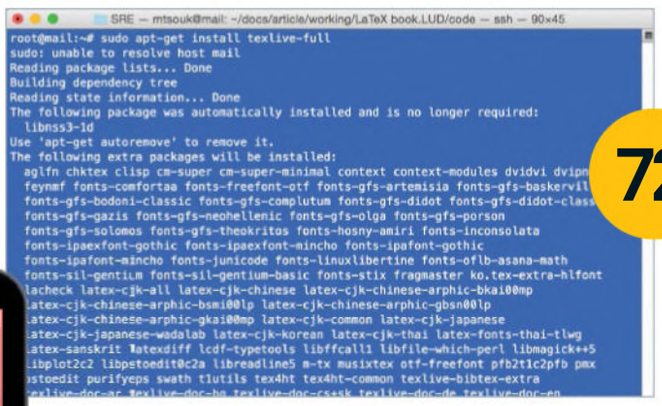
68 Monitor CPU temperature with Dizmo
Turn Raspberry Pi into an Internet of Things

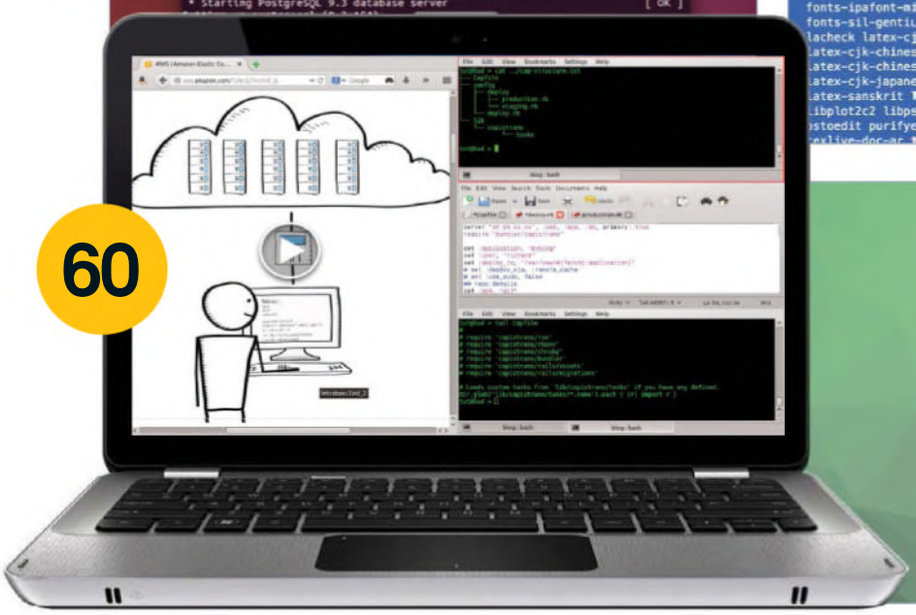
72 Write a book in LaTeX
Typeset, beautify and customise a full book

76 Agile project management with Taiga
Implement an organised project













80

"It's a relief to learn that several tools, tricks and methods can be applied to keep your device and data away from prying eyes"

92 **Simplify interviewing and transcription**
Use Audacity and VLC to make life easier

96 **Secure your Raspberry Pi**
Protect your data with these tips

80 **Make a visual novel game with Python**
Create and play a book-videogame hybrid

84 **Supercharge your Raspberry Pi**
Enhance the performance of your Pi

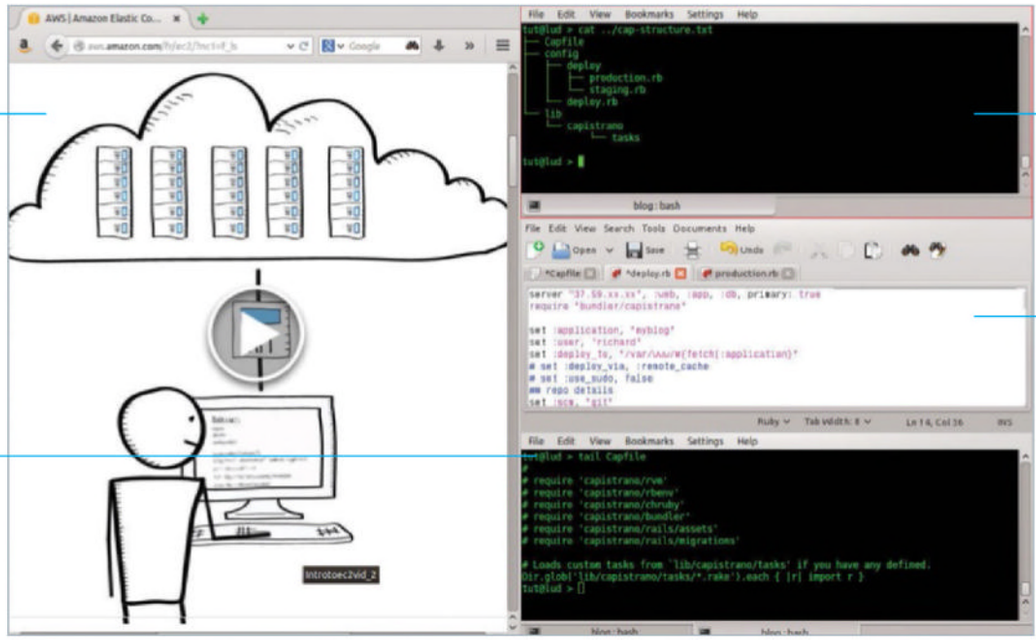
88 **Host a media gallery with MediaGoblin**
Share videos, photos, audio and more



92

No matter where you deploy your app, Capistrano makes it easy to deploy Rails (and other platforms) to *nix servers

Changes like adding a QA stage after production, with qa.rb, are both possible and easy with its modular structure



Built from Ruby, and originally for Rails, Capistrano 3 is a great fit for deploying other web platforms

Capistrano's flexibility and power can mean a lot of config, but it's relatively straightforward

Continuously deploy web apps with Capistrano

Move your web apps' development versions painlessly from staging and testing to deployment on databases and web servers

Capistrano automates deploying web apps to your servers, taking care of tiresome tasks like running a series of remote commands on any box on which you have SSH access. Capistrano's main recipe is deploy, containing tasks such as rollback, which consists of groups of commands. Servers are given roles: app – application servers, web – web servers, and db – database servers. Within this (expandable) framework, it's easy to adjust Capistrano's configuration files for your particular app and collection of servers. Basic set up is simple enough, but Capistrano 3 is a flexible framework and you will need to go a long way beyond this simple introduction if you want to begin to get the full use of it.

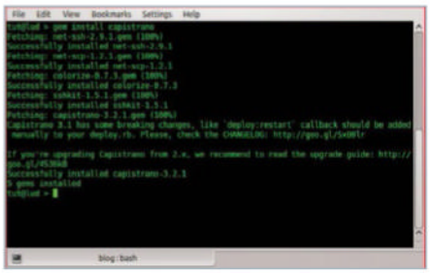
We will need a recent Ruby, Git (plus a GitHub account) and a Rails project you're working on. Also rbenv makes working with Rails easier, and capistrano-rbenv makes sure Capistrano uses the correct rbenv version of Ruby for deployment. It doesn't matter whether you run Passenger, Unicorn or Puma as your app server, but note that there are Capistrano plugins to help with extra tasks on all of them. Search **rubygems.org** for the full choice.

Resources

Ruby >= 1.9
(RBENV makes it easier)

git www.git-scm.com

Capistrano 3 www.capistranorb.com

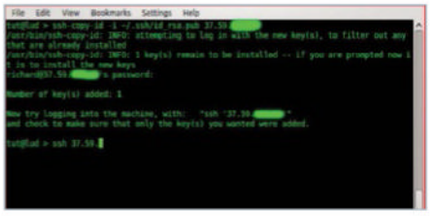


01 Install Capistrano

Essentially, Capistrano copies your app from Git, over SSH, to your server and takes care of all of the operations you'd have to do if you were to move the files by hand. Capistrano will deal with any database migration, changes to files and file names, restarting the web server and so on. Installing Capistrano, and the extras package which is nice to have, is a simple:

```
gem install capistrano
```

Any problems, check your Ruby installation. The capistrano-ext gem you may see referred to elsewhere is no longer essential, as features like extra staging options have been integrated into the main codebase.



02 SSH Keys

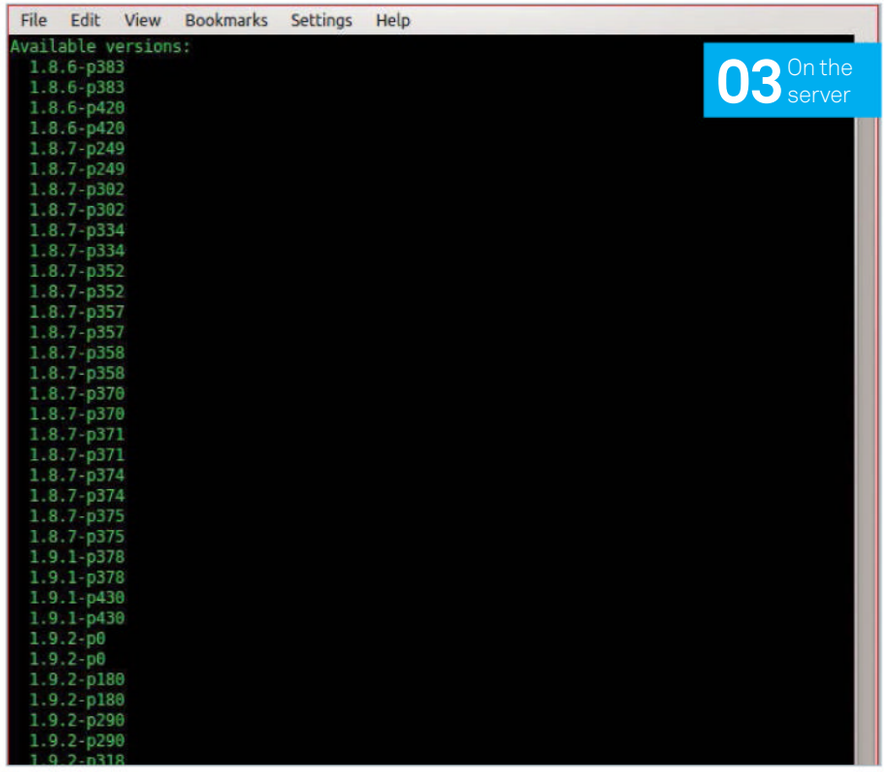
If you've been logging into your web server with a SSH password, it's time to generate keys. This is so that the login can be automated for Capistrano (or any other scripts you want to use – it's a good idea to do this on any server). You'll also need it for your GitHub account if you are going to be setting one up. Start generating the keys with:

```
ssh-keygen -t rsa
```

...if you've not got one already in ~/.ssh/ – and copy the ~/.ssh/id_rsa.pub to the server with:

```
ssh-copy-id -i ~/.ssh/id_rsa.pub user@ ↵
remote-host
```

...which works by substituting your username, and servername or address.



03 On the server

On your servers, you'll need a similar environment of rbenv, Git and your choice of Apache or Nginx. Use rbenv to grab the latest Ruby (or an earlier one if appropriate to your app):

```
rbenv install --list
rbenv install 2.1.3
```

You won't need unnecessary packages like Ruby documentation so when you come to install bundler, specify no docs:

```
gem install bundler --no-ri --no-rdoc
```

Better yet, put:

```
gem: --no-rdoc --no-ri
```

...in ~/.gemrc. You'll also need to set up the database – or separate database server - as required by your setup. A typical Rails use case is SQLite on the developer's laptop and PostgreSQL on the production servers.

04 Bundling gems

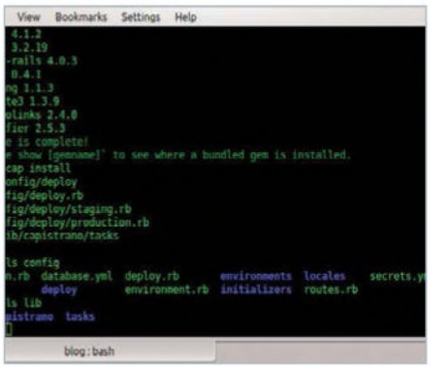
For a Rails project, you can skip the install step and simply edit your Gemfile to include Capistrano and anything else you want. You'll want more gems. In your project's Gemfile:

```
gem 'capistrano', '~> 3.2.1'
gem 'capistrano-rails', '~> 1.1.2'
gem 'capistrano-bundler'
# if you are using RBENV
gem 'capistrano-rbenv', "~> 2.0"
# if you're using Unicorn app server
gem 'unicorn'
# Otherwise gem 'passenger' or 'puma'
```

This will also integrate bundler with Capistrano. `bundle install` downloads the gems specified in your Gemfile and installs them.

The ~> 3.2.1 means that while 3.2.2 will be installed when it's released, 3.3.0 will not to avoid major version changes breaking your code.

"Capistrano will deal with any changes to files and file names"

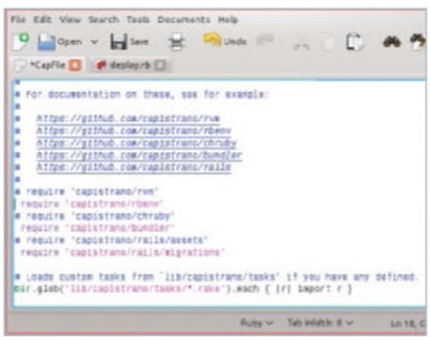


05 Config/deploy

`bundle exec cap install` creates the necessary config files and directories. It is in these that we specify the actions that Capistrano takes to deploy our app to staging or to our production servers.

Note that staging and production are created by default with files under config/deploy, and you can add a qa.rb file to that subdir if you wish to add a third stage. Alternatively, you can create all the extra stages at installation time:

```
cap install STAGES=staging,production,ci,qa
```

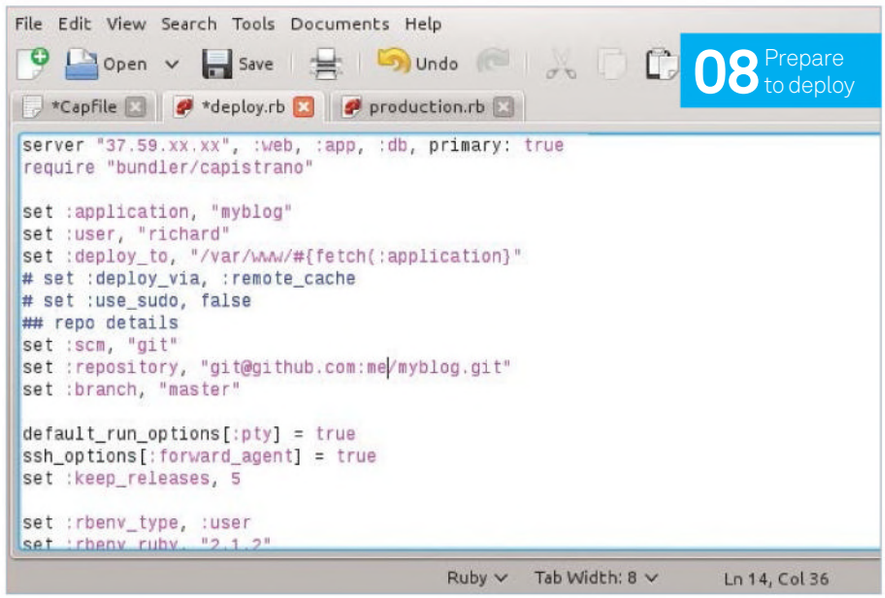


06 Config

The last step created the Capfile, tasks under lib/capistrano and deployed files under config/. Start with editing the Capfile by uncommenting the lines:

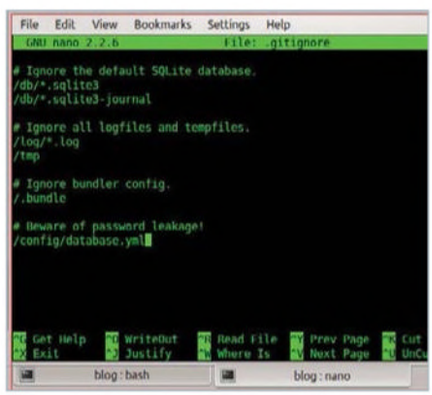
```
require 'capistrano/rbenv'
require 'capistrano/bundler'
require 'capistrano/rails/migrations'
```

...and make sure that the line starting Dir.glob at the end of the above screenshot is present and uncommented. This line ensures that all of the RB files below lib/capistrano get loaded, including any custom tasks in lib/capistrano/tasks that you'll want to later define.



08 Prepare to deploy

> "Note that staging and production are created by default"



07 Secrets

Remember that everything in our app is being shared with the team and anyone else who has access to our Git repository, including exposed passwords. Edit your .gitignore file to add this line:

```
/config/database.yml
```

Now you can edit /config/database.yml for your database locally and in your staging and production environments.

Restart your Rails server and check it's working properly at http://localhost:3000

08 Prepare to deploy

In deploy.rb, ahead of `namespace :deploy`, you should add some lines relevant to your project:

```
require "bundler/capistrano"

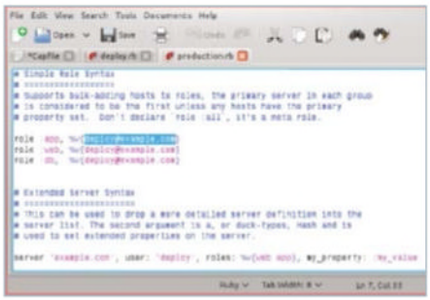
server "37.59.xx.xx", :web, :app, :db, ↵
primary: true

set :application, "myblog"
set :user, "richard"
set :deploy_to, "/var/ ↵
www/#{fetch(:application)}"
# set :deploy_via, :remote_cache
# set :use_sudo, false
## repo details
set :scm, "git"
set :repository, "git@github.com:jsmith/ ↵
myblog.git"
set :branch, "master"

default_run_options[:pty] = true
ssh_options[:forward_agent] = true
set :keep_releases, 5
```

Note that here we're deploying to just one server. You might also want to add some specifics for your Ruby environment:

```
set :rbenv_type, :system # or :user
set :rbenv_ruby, "2.1.2"
set :rbenv_prefix, "RBENV_
ROOT=#{fetch(:rbenv_path)} RBENV_
VERSION=#{fetch(:rbenv_ruby)}
#{fetch(:rbenv_path)}/bin/rbenv exec"
set :rbenv_map_bins, %w{rake gem bundle
ruby rails}
```



09 Test and prepare

Setting tests will halt the deployment should tests fail:

```
# tests under lib/capistrano/tasks/
run_tests.cap
set :tests, []
```

Now edit the `set :server_name` and server lines in config/deploy/production.rb to your server's domain name.

We're about ready to deploy now. You could add a task deploy:setup_config to install the server software, and that would be desirable with a multiserver setup – but we're keeping things simple in this introduction, hence the earlier manual set up of the server.

10 Deploy

Now for deployment. Our config wound up the spring; to set the clockwork in motion we:

```
cap production deploy
```

For that to work first time, you'll have had to have done a bit of work on the config – beyond what we've specifically outlined in the case of many setups. Capistrano is designed to expand and stretch to cover all sorts of circumstances, and your app and server setup won't be exactly the same as anyone else's. Although, that said, if you deploy to a large cloud provider then they may have Capistrano example configs you can copy.

Capistrano's modularity and flexibility means there's a lot to explore to get it doing what you need. It is essentially a utility for running tasks, in parallel, across remote servers...

11 Parallel lines

With the simple on/in/do syntax of the Rake-derived DSL, flexible splitting of tasks across servers is easy. For example, to run something on every server at once:

```
on :all, in: :parallel do
  # parallel task here
end
```

Getting your servers to start a task in sequence, perhaps to avoid hitting a shared database, involves defining :sequence and then:

```
on :all, in: :sequence, wait: 15 do
  # sequential code here
end
```

For a rolling restart of a large cluster, you can group servers together to go in parallel:

```
on :all, in: :groups, limit: 3, wait: 5 do
  # Your rolling restart...
end
```

You can see the parallel execution of code for different groups of servers in the Capistrano developers' example over at **bit.ly/1FuodCh** (look under 'Parallelism'), which was developed specifically to replace the previous version's more hacky parallel do |session|.

12 Off the Rails

There's plenty of documentation available out there to go beyond the simple introductions we give here. The Capistrano website (**http://capistranorb.com**) should be your first port of call, but you'll find docs elsewhere for integrating Capistrano with everything from Jenkins to AngularJS – just double check to make sure that you're reading something that has been updated for Capistrano 3. Integrating Capistrano's scripts for continuous deployment into a larger environment of a continuous integration server like Jenkins is easy enough – a job in Jenkins, as an example, has cap deploy as its build step (and your Git repository as its URL).

Away from Rails, gems do exist that can ease deployment for most web platforms, from Sinatra to Django. For Drupal (with Drush and the CapDrupal gem) you can automate taking the site offline, backing up the database, cloning your new code and pointing the site root there, updating the database, and putting the site back online as well as all of the advantages of cap deploy:rollback.

SSHkit

The Capistrano 3 development process gave birth to the SSHkit library developed by Lee Hambley – who did much of the great work of making Capistrano 3 such an improvement over an already pretty useful piece of code.

SSHKit is a lower level toolkit that Capistrano uses for everything such as logging, formatting, connection management and pooling, parallelism, and batch execution. You too can use it for running commands in a structured way on one or more servers.

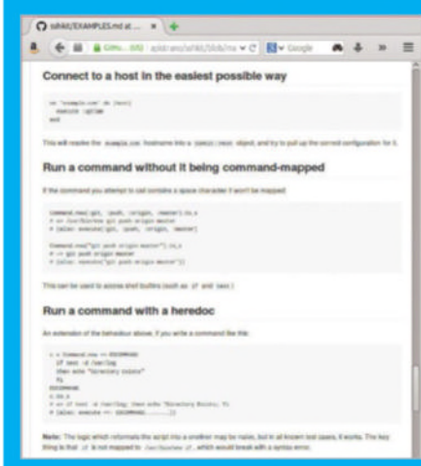
Within Capistrano, you'll find SSHkit called upon most of the time you use on(). To use it yourself, start with some of the examples on the GitHub page and adapt for your site.

Here SSHkit will build a path from the nested directories:

```
on hosts do
  within "/var" do
    puts capture(:pwd)
    within :log do
      puts capture(:pwd)
    end
  end
end
```

Behind the scenes File.join() is taking care of the slashes for you to build the paths and it should return:

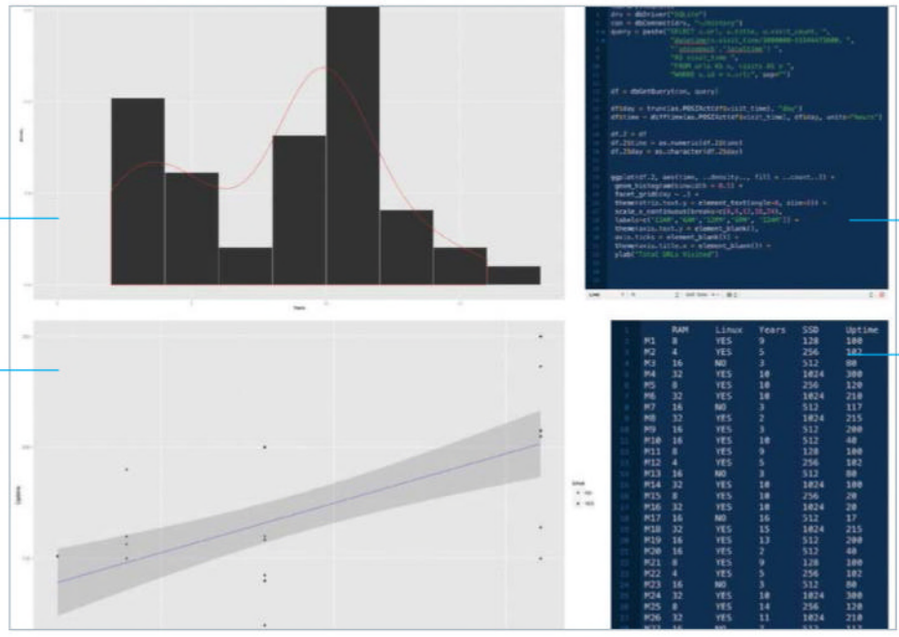
```
/var/
/var/log
```



Above The numerous usage examples on SSHkit's GitHub page hint at its potential

This is a density plot that is drawn on top of a histogram. Drawing using layers has many advantages

This plot combines a scatter plot layer with a smooth layer. The shape of each point depends on the value of the Linux variable found in the LUD dataset



This is the full R code of the 'chrome.R' script used in step 11. The produced image is simply amazing

This is the format and some of the data from the LUD dataset used in this article for illustrating the varied capabilities of ggplot2

Generate complex graphics with ggplot2

Seen as the new version of S, learn how to create truly impressive plots using R and the ggplot2 package

Resources

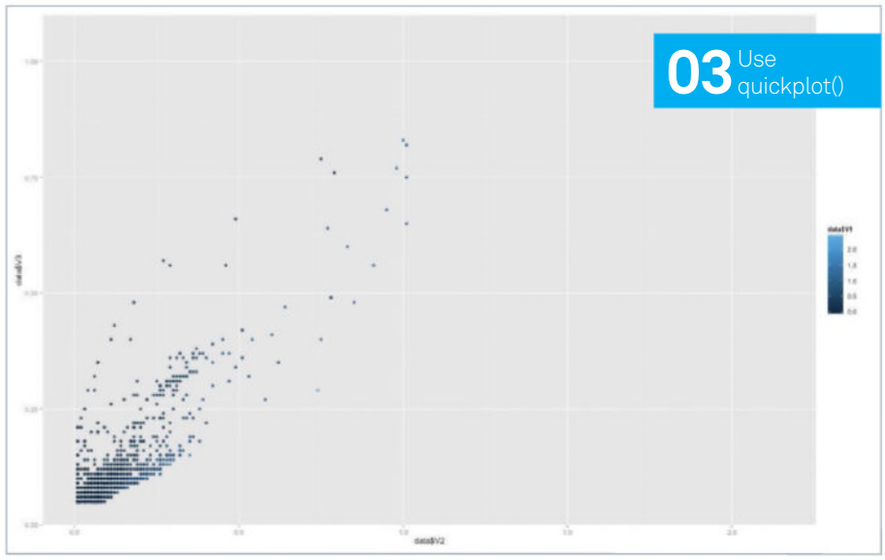
R Project r-project.org
RStudio rstudio.com
ggplot2 ggplot2.org
Documentation docs.ggplot2.org/current
RSQLite bit.ly/1ArJvkc

R is a GNU project based on S, which is a statistics-specific language and environment developed at the famous AT&T Bell Labs. You can think of R as the free version of S. Despite its simple name, R is a powerful piece of software for statistical computing with many capabilities and an interpreted programming language.

R packages can greatly extend its capabilities. Ggplot2 is an R package, written by Hadley Wickham, that is used for producing statistical and data graphics, working with plots in layers. Despite being a powerful package, it is reasonably easy to learn and produces sophisticated and beautiful plots that are of publication quality. Its main difference from most other graphics packages is that it has a deep principal grammar. Learning its grammar, which is based on the book *The Grammar Of Graphics*, will help you design better plots but it is not required in order to follow this article. In other words, the grammar tells that a plot is a mapping from data to aesthetic properties of geometric objects.

This article is full of practical examples that demonstrate the use of ggplot2 for drawing many different kinds of plots, including a plot of the Chrome's history file!

Feeling comfortable with mathematics and statistics is helpful but not vital for understanding this article.



"Experiment with your data and the various types of plots that R and ggplot can generate"

01 Install ggplot2

First run R. The ggplot2 R package isn't installed by default, so check if you already have it installed by running:

```
> require(ggplot2)
Loading required package: ggplot2
```

If it's not installed, download and select:

```
> install.packages("ggplot2")
```

If you execute the library() function without arguments, you'll get a list of installed packages. To get a detailed output, run the **installed.packages()** command without any arguments.

02 About R and data visualisation

R is a command line application, which is fine for plain text output but not for graphical output. RStudio is a more preferable graphical wrapper for R.

When visualising data, remember that not every plot suits every data set. This knowledge comes from experience, and experience comes from experimentation, so don't forget to experiment with your data and the various types of plots that R and ggplot2 can generate.

03 Use quickplot()

The ggplot2 package offers two main functions: quickplot() and ggplot(). The quickplot() function, qplot(), is similar to the plot() R function and is good for simple plots. The quickplot() function hides what happens, whereas ggplot() is harder to use but flexible.

The following commands draw a plot using columns V2 and V3 from the data variable:

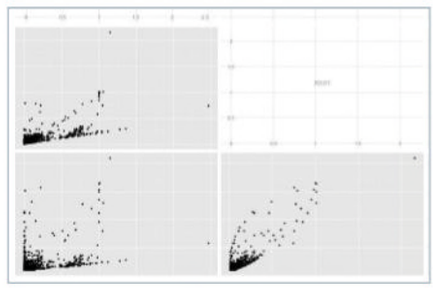
```
> str(data)
'data.frame':   16180 obs. of  3
variables:
 $ V1: num  0 0 0 0 0 0 0.98 1 1.06 1 ...
 $ V2: num  0.01 0.01 0.01 0.01 0.03 0.01
0.58 0.85 1.01 1.01 ...
 $ V3: num  0.05 0.05 0.05 0.05 0.05 0.05
0.27 0.48 0.65 0.75 ...
> quickplot(data$V2, data$V2)
```

The following version adds colour to the output:

```
> quickplot(data$V2, data$V3, color=data$V1)
```

04 Work with ggpairs()

The ggpairs() command finds relations between variables and then calculates the coefficient of correlation value. The coefficient of correlation is linked to the statistical



correlation, a technique that shows whether or not two variables are related. As the coefficient of correlation approaches zero there is less of a relationship (no correlation), whereas the closer the coefficient is to -1 or +1, the stronger the correlation (positive or negative) is. A positive correlation shows that if one variable gets bigger then the other does as well. Conversely, a negative correlation denotes that if one variable gets bigger then the other becomes smaller.

The presented plot was produced using the following commands:

```
> data <-read.table("uptime.data",
 header=TRUE)
> require(ggplot2)
> require(GGally)
> require(CCA)
> ggpairs(data)
```

05 Generate bar plots

Now use a sample dataset for plotting. The LUD dataset, available from **FileSilo**, is stored in a plain text file, named Lud.data. The titles of the columns are named to refer to their values. You can load the dataset into R using the following command:

```
> LUD <- read.table("lud.data",
header=TRUE)
```

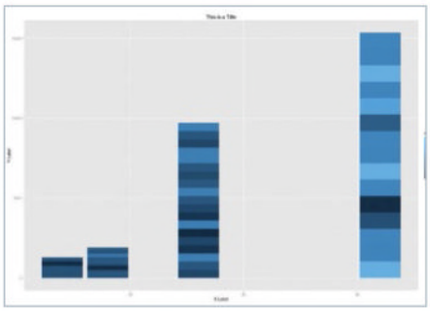
The bar plot is very simple. The following command generates it:

```
> ggplot(LUD, aes(x=RAM, y=SSD)) + geom_
bar(stat="identity")
```

If you type **ggplot(LUD, aes(x=RAM, y=SSD))** without specifying a plot, the command will show the 'Error: No layers in plot' message.

To change the colour of the bars, try the following variation:

```
> ggplot(LUD, aes(x=RAM, y=SSD,
fill=Uptime)) + geom_bar(stat="identity")
```



06 Add titles and labels

Sooner or later, it's likely that you will want to add a title and labels to the output. Adding a main title is simple – you just need to make use of the labs() function in order to do so. The previously plotted bar plot can thus be modified with inclusion of the the following command at the end:

```
> ggplot(LUD, aes(x=RAM, y=SSD,
fill=Uptime)) + geom_bar(stat="identity")
+ labs(title="This is a Title")
```

Adding X and Y labels can be done by entering the following:

```
> ggplot(LUD, aes(x=RAM, y=SSD,
fill=Uptime)) + geom_bar(stat="identity")
+ labs(title="This is a Title") + xlab("X
Label") + ylab("Y Label")
```

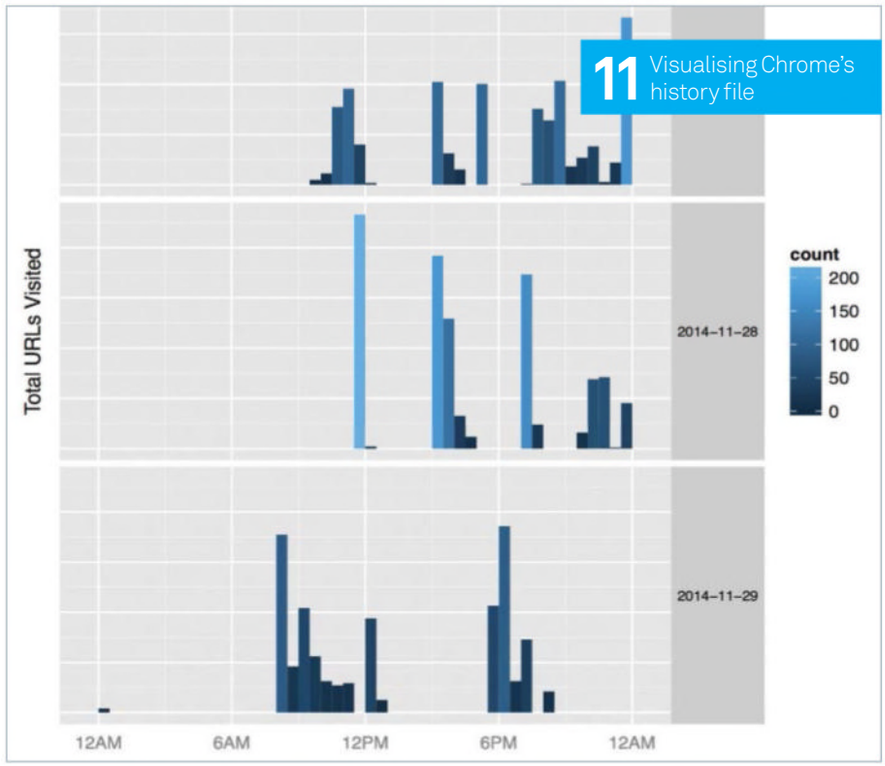
07 More about titles and labels

You can add or change the appearance, size, font and colour of all the titles and labels. The following command makes the title blue and its size larger using the theme() function:

```
> ggplot(LUD, aes(x=RAM, y=SSD,
fill=Uptime)) + geom_bar(stat="identity")
+ labs(title="This is a Title") + xlab("X
Label") + ylab("Y Label") + theme(plot.
title = element_text(size = rel(2),
colour = "blue"))
```

To change the attributes of the X and Y axes, use the axis.line function:

```
> ggplot(LUD, aes(x=RAM, y=SSD,
fill=Uptime)) + geom_bar(stat="identity")
+ labs(title="This is a Title") + xlab("X
Label") + ylab("Y Label") + theme(plot.
title = element_text(size = rel(2),
colour = "blue"), axis.line = element_
line(size = 3, colour = "red", linetype
= "dotted"))
```



11 Visualising Chrome's history file

08 Create histograms

Generate histograms using the geom_histogram() function, similar to the geom_bar() function, and change the number of bars using the binwidth argument. Plot a simple histogram using the following command:

```
> ggplot(LUD, aes(Years)) + geom_
histogram(binwidth=1, color='gray')
```

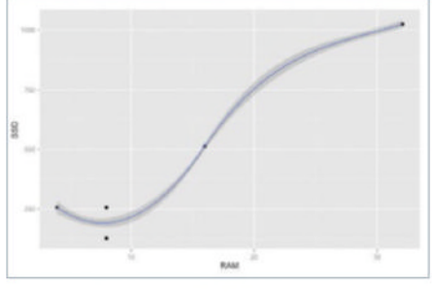
Use geom_density() function for a density plot:

```
> ggplot(LUD, aes(Years)) + geom_
density(binwidth=1)
```

The following command draws a histogram and a density plot on the same plot:

```
> ggplot(LUD) + geom_
histogram(aes(Years, ..density..),
binwidth=2, color='white') + geom_
density(aes(Years, ..density..),
binwidth=2, color='red')
```

If you put the geom_density() command first, the histogram will be on top of the density plot and therefore the density plot will not be completely visible.

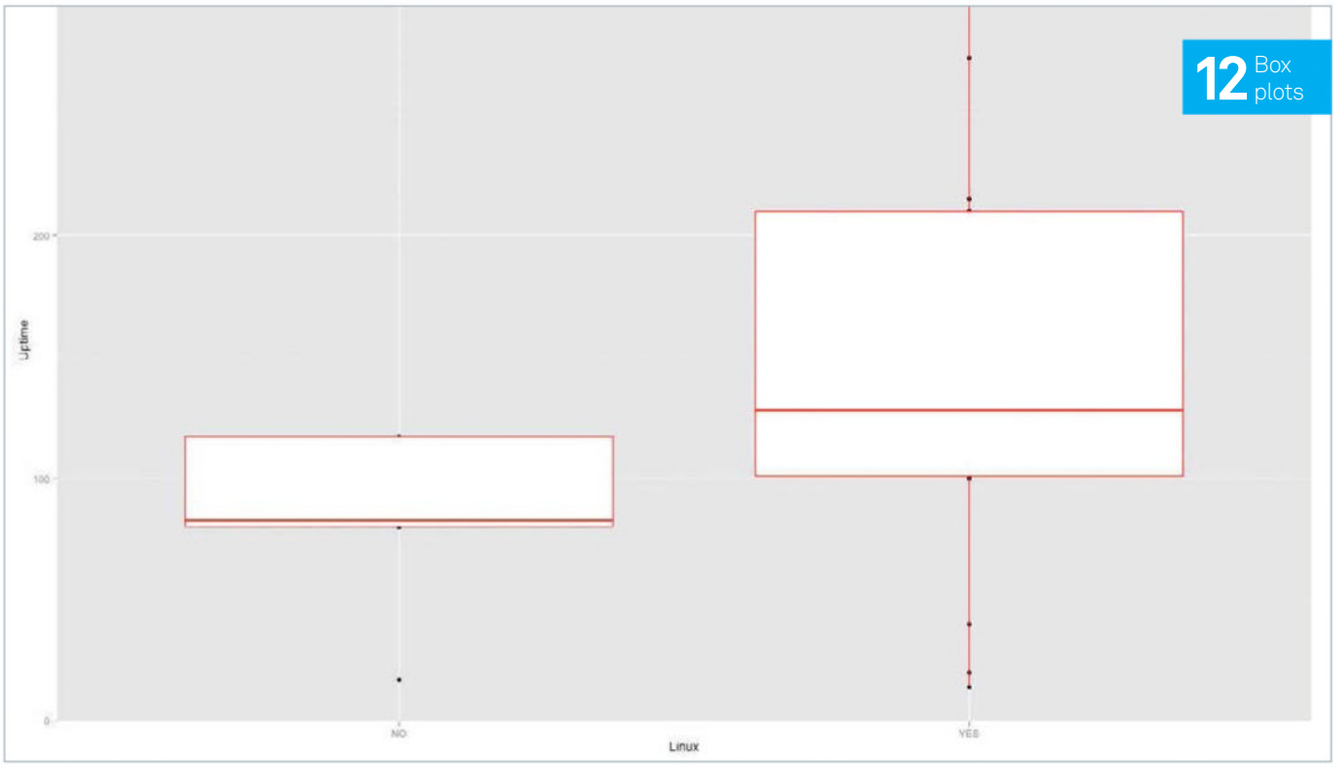


09 Add smooth layers

Another type of layer is the smooth layer. It doesn't display raw data, but rather a statistical transformation of the data.

The (method="lm") parameter generates a linear regression line instead of a LOESS (local polynomial regression fitting) curve, which is the default for samples with less than 1000 observations. For bigger samples, the default method is called GAM (generalised additive model). The produced plot was generated with the following commands:

```
> q <- ggplot(LUD, aes(x=RAM, y=SSD))
> q + geom_point() + geom_smooth()
> q + geom_point() + geom_
smooth(method='lm')
```



10 Work with shapes and facets

The following plot draws points using different shapes depending on the value of the non-continuous Linux variable:

```
> ggplot(LUD, aes(x=RAM, y=Uptime)) +
geom_point(aes(shape = Linux))
```

A facet allows you to split up your data by one or more variables and then plot the subsets of data together. Using facets is also a great way of generating conditional plots. Try the following point plot, which will generate two plots depending on the two different values of the Linux variable:

```
> ggplot(LUD, aes(x=RAM, y=Uptime)) +
geom_point() + facet_grid(Linux ~ .)
```

The facet_grid() function works fine when using continuous variables.

11 Visualising Chrome's history file

The history file of Chrome (simply called History) stores its history of visited websites in SQLite3 database format. Therefore, you can use the RSQLite R package to read it. The 'chrome.R' script generates an impressive output using RSQLite and ggplot2 with many layers. It can be executed as follows:

```
$ ./chrome.R
Loading required package: methods
Loading required package: DBI
$ ls -l Rplots.pdf
-rw-r--r--@ 1 mtsouk  staff  5089 Nov 27
09:42 Rplots.pdf
```

The produced result is automatically stored in a file called 'Rplots.pdf' file.

12 Use box plots

A box plot can give you information regarding the shape, the variability and the median of a data set, quickly and efficiently. The presented box plot was generated using the following R command:

```
> ggplot(LUD, aes(Linux, Uptime)) +
geom_point() + geom_boxplot(colour =
"red") + labs(title="A Box Plot")
```

Based on the two discrete values of the Linux variable, the output is divided into two subsets. For each subset, a separate box plot is produced individually.

13 Create R Scripts

It is very useful to learn how to create R scripts in order to use ggplot2 inside bigger scripts that can run as cron jobs. A sample script file, named 'ggplot.R' shows you how:

```
$ chmod 755 ggplot.R
$ ./ggplot.R
$ ll
total 160
-rwxr-xr-x@ 1 mtsouk  staff    234 Nov
14 22:41 ggplot.R
-rw-r--r--  1 mtsouk  staff  73820 Nov
14 22:43 ggplot.png
$ file ggplot.png
ggplot.png: PNG image data, 1280 x 800,
8-bit/color RGBA, non-interlaced
```

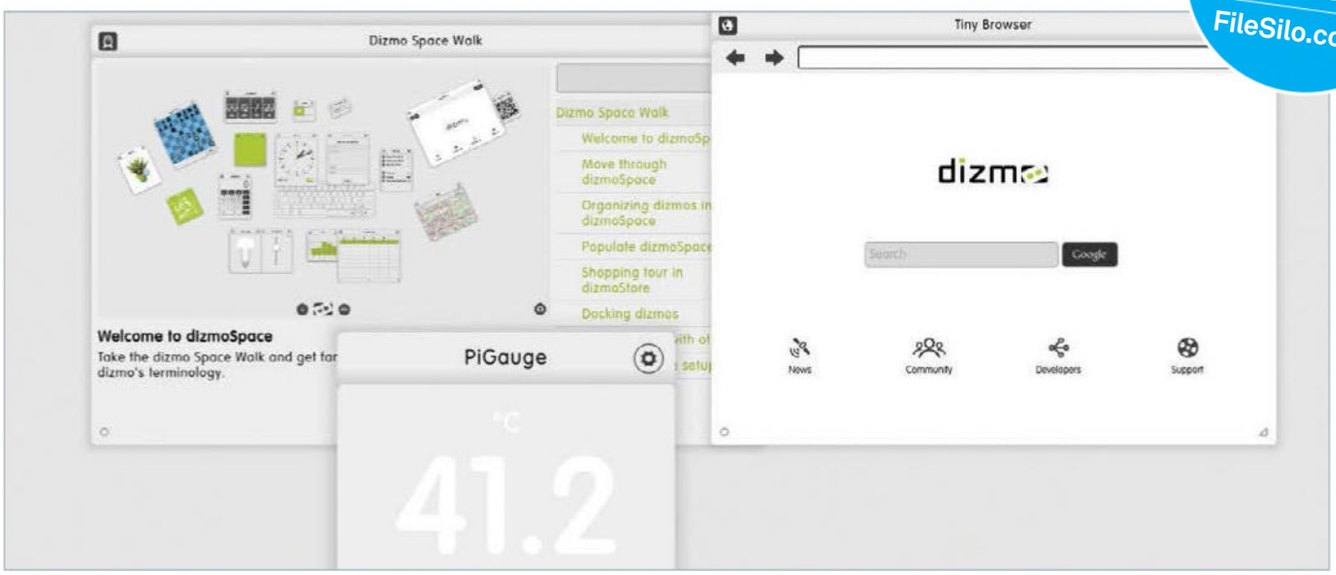
14 Final thoughts

Before we wrap up this tutorial, here are some things to keep in mind. The more you use ggplot2 and the better you know your data, the better the output you'll achieve. Just make sure that you don't forget that ggplot2 works using layers! Also, to take full advantage of plotting you'll have to plot the right metrics, and finding the right metrics is not always as simple as it might seem.

Monitor CPU temperature with Dizmo

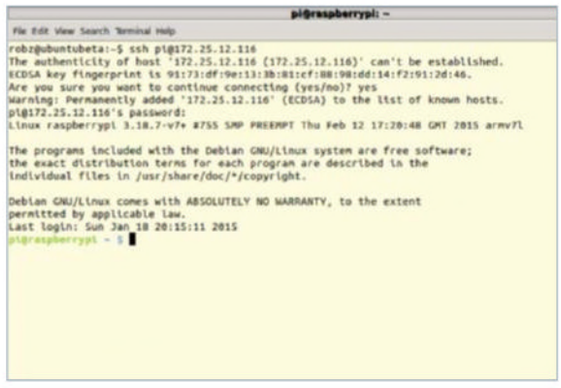
Turn your Raspberry Pi into an Internet of Things with this CPU temperature gauge tutorial

Full code FileSilo.co.uk



The Raspberry Pi is an exciting prospect for people interested in an Internet of Things – size, power and flexibility make it perfect for powering any Internet-connected device around the home or office. Setting up a Raspberry Pi to be the brain of an IoT network isn't exactly a case of selecting the right software in Raspbian, though; there's a lot of custom work you need to do to get one going.

This is where Dizmo comes in, enabling you to control IoT objects using an online API that you can then access remotely. To show you how it works, we're going to have it track the Raspberry Pi's core temperature. In this tutorial we are going to work entirely over SSH, but you can easily do this straight on the Pi – the benefit of SSH though is that for a real IoT, it will be easier to maintain remotely.

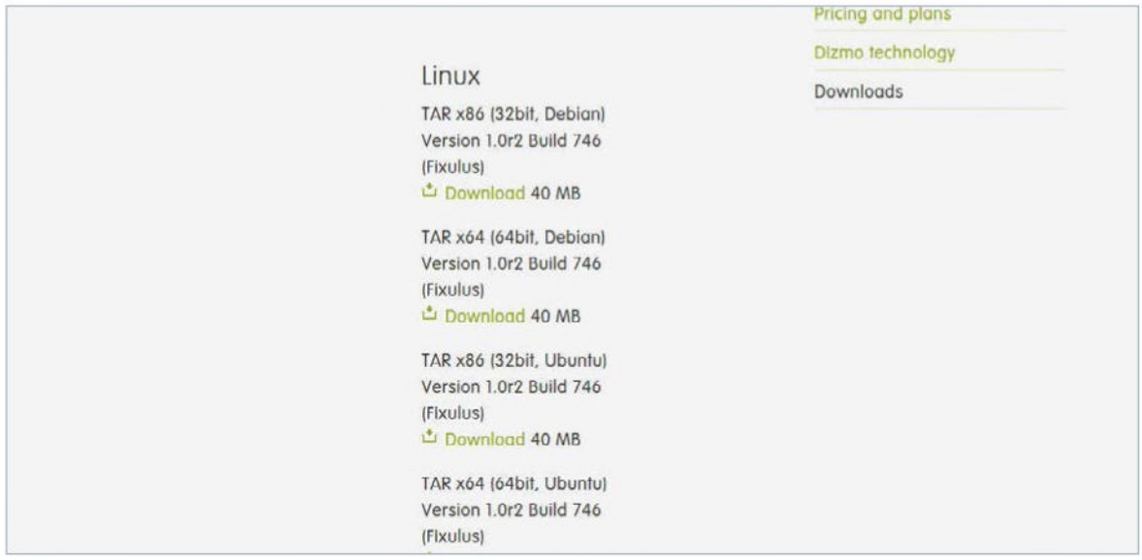


Above Dizmo is designed to be a multi-touch interface

01 Dial into your Pi

Make sure your Raspberry Pi can connect to your network, either via Wi-Fi or ethernet cable, and find out the IP address by using **ifconfig**. Use this IP to dial into the Pi from another system with:

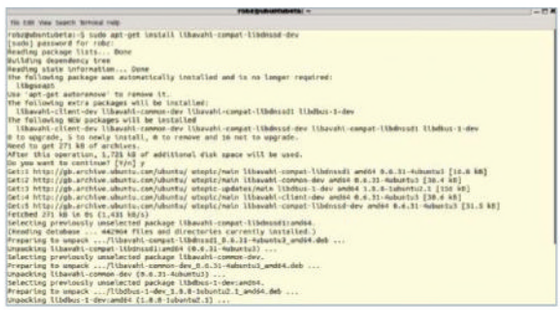
```
$ ssh pi@[IP address]
```



Left Builds are available for various distros on the Download page, and you can also check the pricing plans

02 Install dizmoSpace

If you haven't already, head to **www.dizmo.com**, grab dizmoSpace and install it to the system you plan for it to work with. All you need to do is download the zip and unpack it, then click the Dizmo icon or run it from the terminal.



03 Launch issues?

If Dizmo is complaining about libraries when you try to run it, you'll need to install some extra software. Open the terminal on the PC you're working from and install the extra software with the following:

```
$ sudo apt-get install libavahi-compat-libdnssd-dev
$ sudo apt-get install libavahi-client-dev
```

04 Download node.js

Now, we need to grab the latest version of node.js for the Raspberry Pi. Back in the SSH connection to your Raspberry Pi, use the following:

```
$ sudo wget http://node-arm.herokuapp.com/
  node_latest_armhf.deb
$ sudo dpkg -i node_latest_armhf.deb
```

"A Dizmo widget is a HTML file, packaging resources together to create an interface or graphic. Our HTML file uses jQuery"



05 Add framework

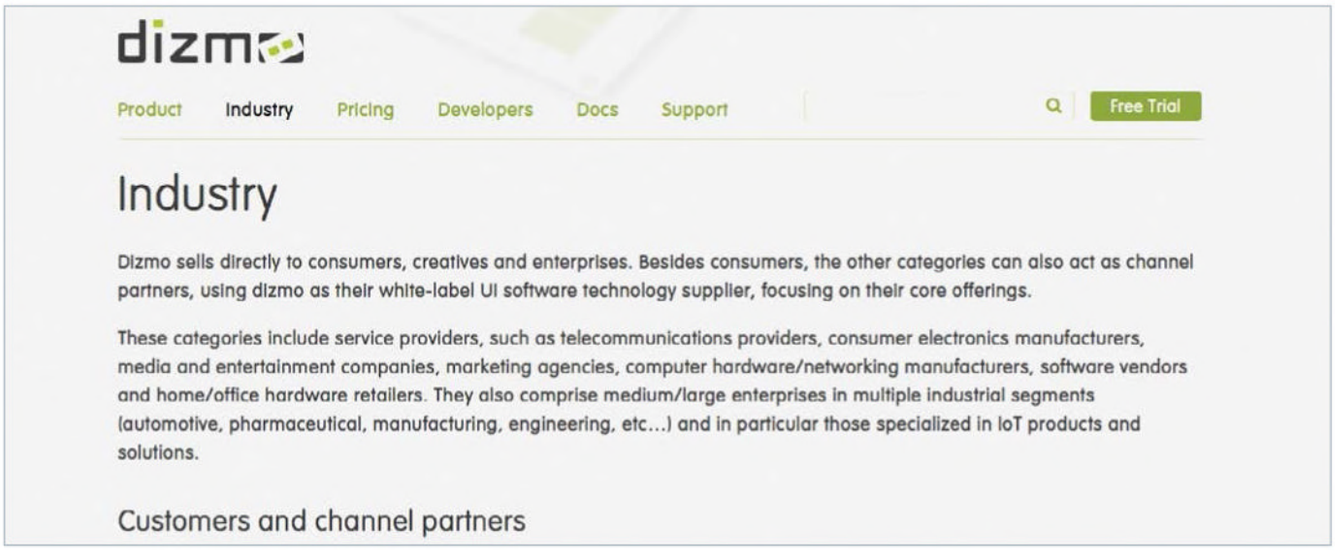
Use **node -v** to check if it's installed correctly – it should spit out a version number for you. Once that's done, install express.js, which will be our web application framework:

```
$ sudo npm install -g express
$ sudo npm install -g express-generator
```

06 Install framework

We'll create the folder www in var and create a symlink for everything to run. Do this by moving to var, creating www and making the symlink with:

```
$ cd /var
$ sudo mkdir www
$ cd www
$ sudo ln -s /usr/local/lib/node_modules/
  /node_modules
```



Above As it's multi-touch, Dizmo is perfect for interactive table displays in meetings

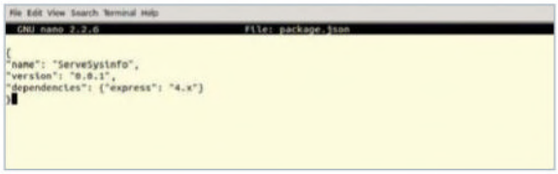
Internet of Things

It's not a very descriptive term, but the Internet of Things can be almost anything. Any item that is or can be connected to the internet or networks, such as modern automated lights, can be connected up to Dizmo and the Raspberry Pi.

Dizmo space walk Enjoy some pre-installed projects to see exactly what Dizmo can do

PiGauge Create a custom app to monitor the temperature of your Raspberry Pi, and then go even further

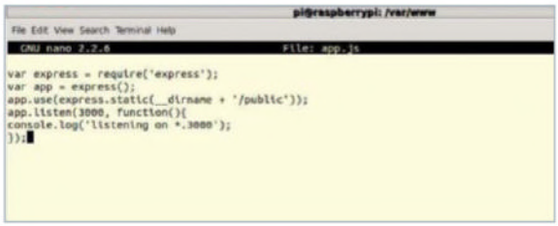
Browser Create an entire custom display using a variety of information that can connect to and through the Pi



07 Package file

First, create the file package.json with `sudo nano package.json`, then enter:

```
{
"name": "ServeSysinfo",
"version": "0.0.1",
"dependencies": {"express": "4.x"}
}
```



08 App node

Now, create a file called app.js and enter the following:

```
var express = require('express');
var app = express();
app.use(express.static(__dirname + '/public'));
app.listen(3000, function(){
console.log('listening on *.3000');
});
```

09 Start node.js

You can now start the node server by typing in:

```
$ node app.js
```

It will say it's listening on *.3000. Start up a new terminal, **ssh** in, and create the folder /public with **mkdir /public** to save all of the CPU data in.



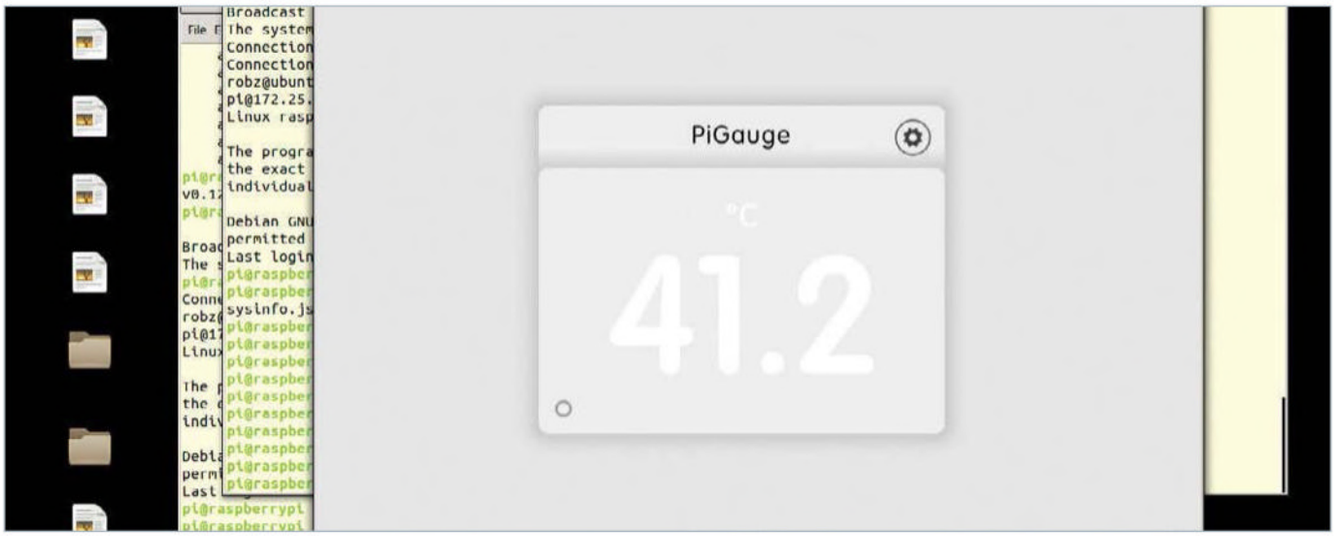
10 CPU information

We are going to use the **vcgencmd** command to get the CPU information from the Raspberry Pi. We will write a script that will do this and then write the info to sysinfo.json. Download the file grabsysinfo.sh from FileSilo and put it in /usr/local/bin.

11 Make a cronjob

We will make it so that the temperature is updated every ten minutes. You can make it update much faster if you want, but have a play around with that. Open up cron with `sudo crontab -e` and add this at the end:

```
*/10 * * * * /usr/local/bin/grabsysinfo.sh
```



Above We've gone for a simple CPU temperature gauge, but the possibilities really are endless



12 Start creating the widget

It is time to actually start building the widget. First of all, create a folder on your local machine called Gauge and **cd** to it. Now you need to download the first file called info.plist into here by using the following:

```
$ wget x/info.plist
```



13 Index file

A Dizmo widget is basically a HTML file, packaging resources together to create an interface or graphic. Here, we have the main HTML file that uses jQuery, which helps display the temperature. Still in the Gauge folder, download it with:

```
$ wget x/index.html
```

"With these building blocks, you can now start doing more interesting IoT things – controlling the GPIO ports, getting more information"

14 Style guide

Now we'll add the CSS style sheet for the Dizmo widget. As usual, this styles up the display on the page that will become our widget. Download it with:

```
wget x/style.css
```

15 Final application

The final step is to create the application.js file, which will call the temperature from the Raspberry Pi using Ajax. You can download it using:

```
wget x/application.js
```

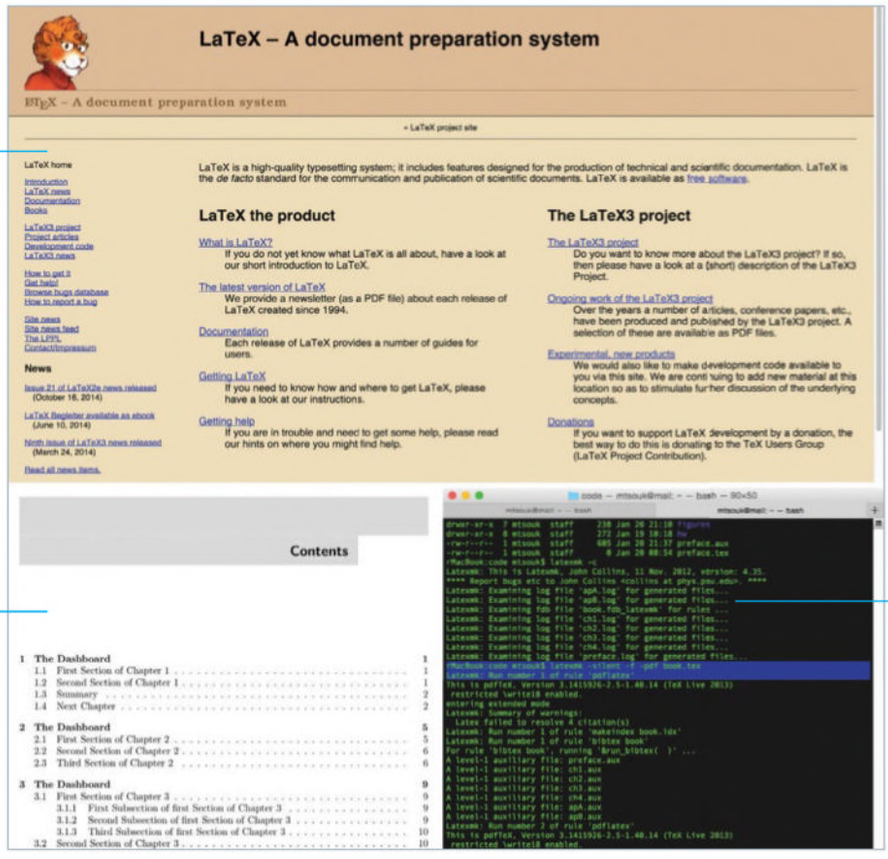
Change the IP address to the one on your Pi.

Once that's done, you can test out the widget – compress the Gauge folder to a .zip and then change the .zip to a .dzm. Launch dizmoSpace and drag the dzm file onto it for it to start.

16 Get coding

With these building blocks, you can now start doing more interesting IoT things – controlling the GPIO ports, getting more information, having it connect to other objects to control them as well. Check out the Dizmo website for more details on projects that you can do.

This is the main website of the LaTeX project where you can find further useful information



Create your own table of contents, list of figures or list of tables easily

Execute the latexmk Perl script in silent mode; Latexmk is a handy automatic LaTeX document generation routine that saves you time

Write a book in LaTeX

Learn how to typeset, beautify and customise a whole book using LaTeX and its extensive packages

Resources

LaTeX project
www.latex-project.org

Comprehensive TeX Archive Network
www.ctan.org

Latexmk
http://users.phys.psu.edu/~collins/software/latexmk-jcc

The LaTeX Companion, 2nd Edition, Addison Wesley, 2004

Donald Knuth created TeX in the 1970s as a computer language for use in typesetting, after wanting to write books on computer algorithms and finding that no previous typesetting system was acceptable for him. Its origins resonate with the story of the C programming language that was created in order to write the UNIX operating system – TeX had many low-level commands and it was difficult to use, so Leslie Lamport decided to make it a little easier to digest. He programmed many higher-level TeX commands and that became LaTeX, which is widely used today.

Many people want to typeset a large body of work or a book of around 350 pages, for example, but the biggest concern can be the choice between using LaTeX or Adobe InDesign. LaTeX often proves itself to be the best option, so this tutorial will go through the process and some of the modifications and additions that can be made to a book LaTeX-style.

Although this article assumes that you are already familiar with LaTeX, if you have never heard of it and are wondering why it's so popular, you should know that it helps many book and dissertation authors construct their work easily.

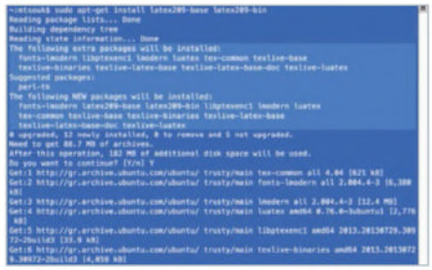
01 Install LaTeX

First you need to install LaTeX. There is a plethora of packages out in the wild that contain the name LaTeX, so running **apt-cache search latex** will return a lot of output. You can get a more helpful output by simply executing the following command:

```
$ apt-cache search latex | grep ^latex
```

Your journey to using LaTeX will start by running the following command:

```
$ sudo apt-get install latex209-base
latex209-bin
```



02 Use LaTeX

After installing the basic LaTeX packages you should try to compile the consequent LaTeX code to make sure that everything works exactly as you expected:

```
\documentclass{article}
\title{The LaTeX version of the Hello
        World program}
\author{Mihalis Tsoukalos}
\date{January 2015}
\begin{document}
   \maketitle
   Hello world!
\end{document}
```

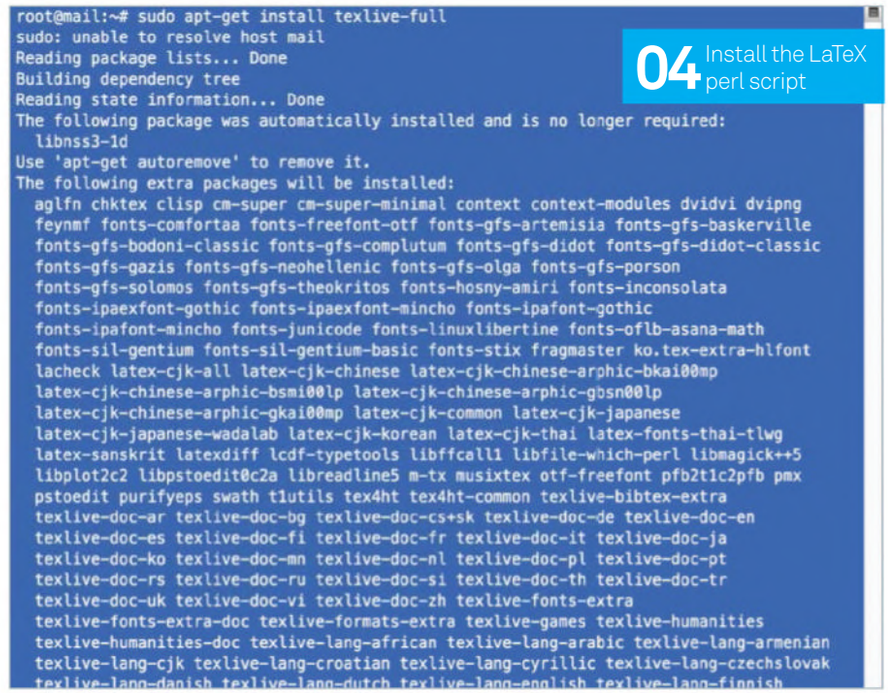
You can compile the document using the following command:

```
$ latexmk helloWorld.tex
```

The previous command produces a DVI file that you can convert into PDF format as follows:

```
$ dvipdf helloWorld.dvi
```

If you view the generated file you can easily understand that the default LaTeX styles produce high quality output. The problem is that if everyone is using the default styles, all books produced using LaTeX will look exactly the same!



03 Pros and cons

LaTeX has its advantages. It comes with many default styles and if they are sufficient for you, then start writing immediately! It's also fast to type and edit text, so you can use traditional UNIX tools to make changes to your LaTeX code. As a consequence, you don't need a very fast computer to run LaTeX. Additionally, LaTeX files are easily interchangeable between different platforms. One of its biggest advantages is that the output looks highly professional because LaTeX is a pro tool.

However, you do have to compile the LaTeX code to see its output, and LaTeX needs time and experimentation to set up and change the default document styles, which can be annoying.

04 Install the latexmk Perl script

This command installs a highly recommended Perl script to improve the whole book-building process:

```
$ sudo apt-get install latexmk
```

From now on you can translate your LaTeX code into PDF format using the following command:

```
$ latexmk -pdf book.tex
```

Most of the packages you will need are installed by default. Installing a new LaTeX package can be tricky – the best thing to do is read the documentation and follow the instructions before trying to install it. For this tutorial it's also worth installing the texlive-full, texlive-math-extra, texlive-extra-utils, texlive-generic-extra and texlive-latex-extra packages.

05 Organise the files

It's time to start organising the files for a more simplified process. The name of the core LaTeX file will be book.tex. Instead of using a big and unmanageable LaTeX file, you can make it more overseeable and put the book chapters and the appendices in separate files using the **include** LaTeX command:

```
\include{ch1}
\include{apA}
```

Here, LaTeX will search for files named ch1.tex and apA.tex in the current working directory. This is the most important task of the whole process because it allows you to edit smaller and more manageable files.

We will use four chapters and two appendices in order to make our example book, but you can use more or less pages on future projects if you wish. After creating the files for all the book chapters and appendices, and referencing them inside book.tex, you are completely ready to start adding content.

06 Create a bibliography

LaTeX offers BibTex for dealing with bibliographic references. All BibTeX entries will be located in a file called booklist.bib. Each BibTeX entry has the following format:

```
@book{Kernighan84,
 author = {Brian W. Kernighan and Robert
           Pike},
 title = {The UNIX Programming
          Environment},
 year = {1984},
 isbn = {013937681X},
 publisher = {Prentice Hall Professional
Technical Reference},
}
```

The following LaTeX commands are used for beautifying and inserting the bibliography into this project:

```
\bibliographystyle{alpha}
\addcontentsline{toc}{chapter}
{Bibliography}
\bibliography{booklist}
```

You can add a reference to the Kernighan84 book in your LaTeX code as follows:

```
\cite{Kernighan84}
```

07 Sort content

You can LaTex to sort and organise content more easily. LaTeX generates pages with table of contents, list of figures and list of tables. You can create your own table of contents (TOC) using this command:

```
\tableofcontents
```

If you only want to include entries for chapters and sections, include the next command before the previous command in Step 6:

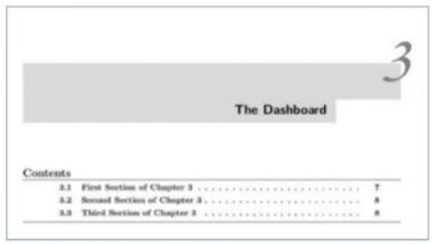
```
\setcounter{tocdepth}{1}
```

In order to include the list of figures you might have in your book you can do so by inserting the following command:

```
\listoffigures
```

If you have tables in your book, you can generate the list of tables as follows:

```
\listoftables
```

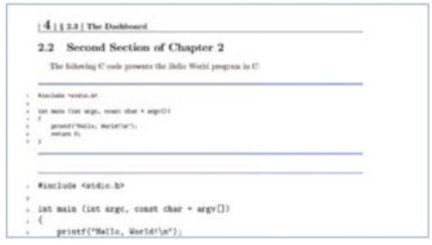


08 Mini table of contents

If your book chapters are on the large side you may need to add a mini table of contents at the beginning of each chapter. There is a LaTeX package called minitoc that does the job. The next LaTeX code adds support for the mini TOC functionality:

```
\usepackage{minitoc}
\setcounter{minitocdepth}{1}
```

The previous commands should be combined with the \dominitoc command that must be used once to turn on the mini TOC functionality. Finally, type \minitoc at the beginning of each chapter to actually add the mini table of contents.



09 Format code

The book is going to contain multiple blocks of code to showcase certain techniques, therefore the code must be well formatted. Using the following LaTeX code you can define a new style called MyCode for formatting code:

```
\usepackage{relsize, color, fancyvrb}
\CustomVerbatimEnvironment{MyCode}
{Verbatim}
        {numbers=left,frame=lines,framerule=
1pt,rulecolor=\color{blue},framesep=4mm}
```

Creating a style saves you time. Additionally, if you want to make a global change to the output format of code in your book, all you have to do is go to its definition, make the changes and recompile the book. Also, if you want to create a new style similar to an existing one, you can copy and paste the existing style definition code, choose a different name and make the modifications you want.

You can now use the MyCode style inside LaTeX using the following command:

```
\begin{MyCode}[fontsize=\relsize{-1}]
#include <stdio.h>
int main (int argc, const char * argv[])
{
    printf("Hello, World!\n");
    return 0;
}
\end{MyCode}
```

If you change the \relsize value from -1 to +1, the code size is going to get bigger.



10 Include a header and footer

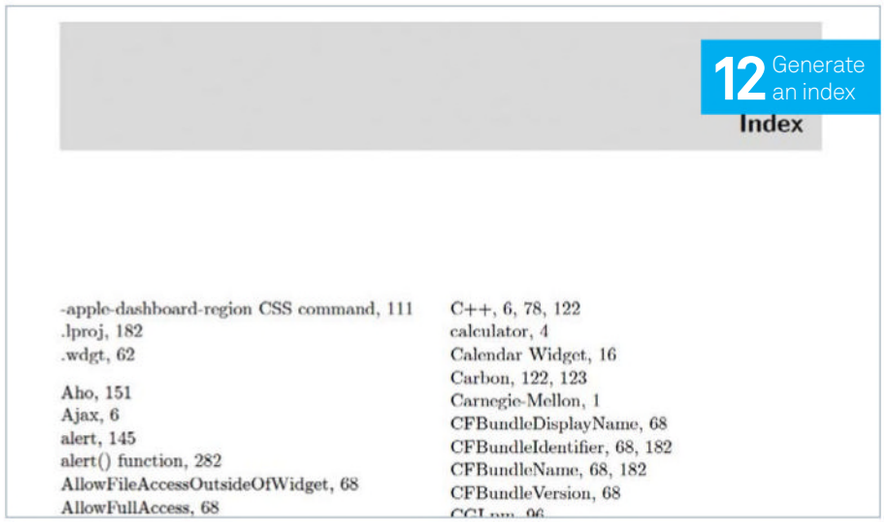
The following LaTeX code changes the header and the footer of each book page. Right pages (RO) have a different rule to left pages (LE). It's also worth noting that the first page of each chapter (CO) has another rule that puts the page number at the footer of it without adding any header information.

```
\renewcommand\headrule
{{%
   \color[gray]{0.5} \hrule height 1pt
   width\headwidth
   \vspace{-4pt}}}

\fancyhead[RO]{%
  {\bfseries\S\ \thesection\ \textbar\ \
   LARGE\thepage\normalsize\ \textbar}
}

\fancyhead[LE]{%
    {\bfseries\textbar\ \LARGE\thepage\
     normalsize\ \textbar\ \S\ \
     thesection\ \textbar\ \leftmark}
}

\fancypagestyle{plain}{%
    \fancyhf{}
    \fancyfoot[CO]{%
    {\bfseries\LARGE\thepage}
     }
    \renewcommand{\headrulewidth}{0pt}%
}
```



You should first insert the following code for the modifications to work:

```
\usepackage{fancyhdr}
\pagestyle{fancy}
\fancyhf{}
\renewcommand{\chaptermark}[1]{\
markboth{#1}{}}
```

The last command is for resetting the existing definition of the header and the footer.

11 Format figures

You can easily alter the existing format of a picture caption by using the following LaTeX commands:

```
\usepackage{caption}
\DeclareCaptionLabelSeparator{par}{\par}
\DeclareCaptionFormat{dashedlabel}{\
 textbf{---} #1 \textbf{---}#2#3}
\captionsetup{format=dashedlabel,margin=1
 cm,singlelinecheck=true, font=small,labe
 lfont={sc,bf,},textfont=it,justification=ce
 nterlast,labelsep=par}
```

Now you will be able to add a specific figure in your book as follows:

```
\begin{figure}[tb]
        \centering
        \fbox{\scalebox{0.45}{\
         includegraphics{figures/ch1/f0101.
         jpg}}}
      \caption{Adding a figure}
      \label{ch10:fig1}
\end{figure}
```

12 Generate an index

The following command helps you create a book index:

```
\usepackage{makeidx}
```

The next LaTeX command puts the index information into the generated file:

```
\printindex
```

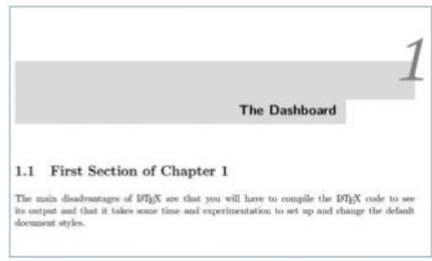
This code adds the word Knuth to the index:

```
\index{Knuth}
```

13 Add tables

This code produces an elegant table to blend in with the rest of the book:

```
\begin{table}[t]
\centering
\setlength\extrarowheight{2.5pt}
\setlength\extrarowheight{2.5pt}
\begin{tabular}{cccc}
\hline  \addlinespace
\textbf{Name} & \textbf{Size in Kbytes} &
 \textbf{\# of files} & \textbf{\# of keys
 in Info.plist} \\  \addlinespace \hline
amazonsearch.wdgt &   144 & 8    & 13 \\
Tags - HTML.wdgt & 88 & 17 & 11 \\
Temperature Monitor.wdgt & 416 & 50 & 10 \\
Wikipedia.wdgt & 696 & 125 & 12 \\ \
addlinespace \hline
\end{tabular}
\caption{Statistical Information.}
\label{ch3:stats}
\end{table}%
```



14 Some other useful info

Producing a more fancy and professional chapter heading can be done easily using the fncychar package:

```
\usepackage[Bjornstrup]{fncychap}
```

15 Work with the NOTE style

Before talking about the NOTE style you should first download the picins.sty file and put it where your LaTeX files are:

```
$ wget http://tug.ctan.org/tex-archive/
macros/latex209/contrib/picins/picins.sty
```

The NOTE style was defined as follows:

```
\usepackage{picins}
\usepackage{amsthm}
\newcommand\NOTE{\linethickness{1mm}\
parpic(14mm,5mm)[sl]{NOTE}\noindent}
```

You can now add a note as follows:

```
\NOTE A small note doesn't look very elegant
```

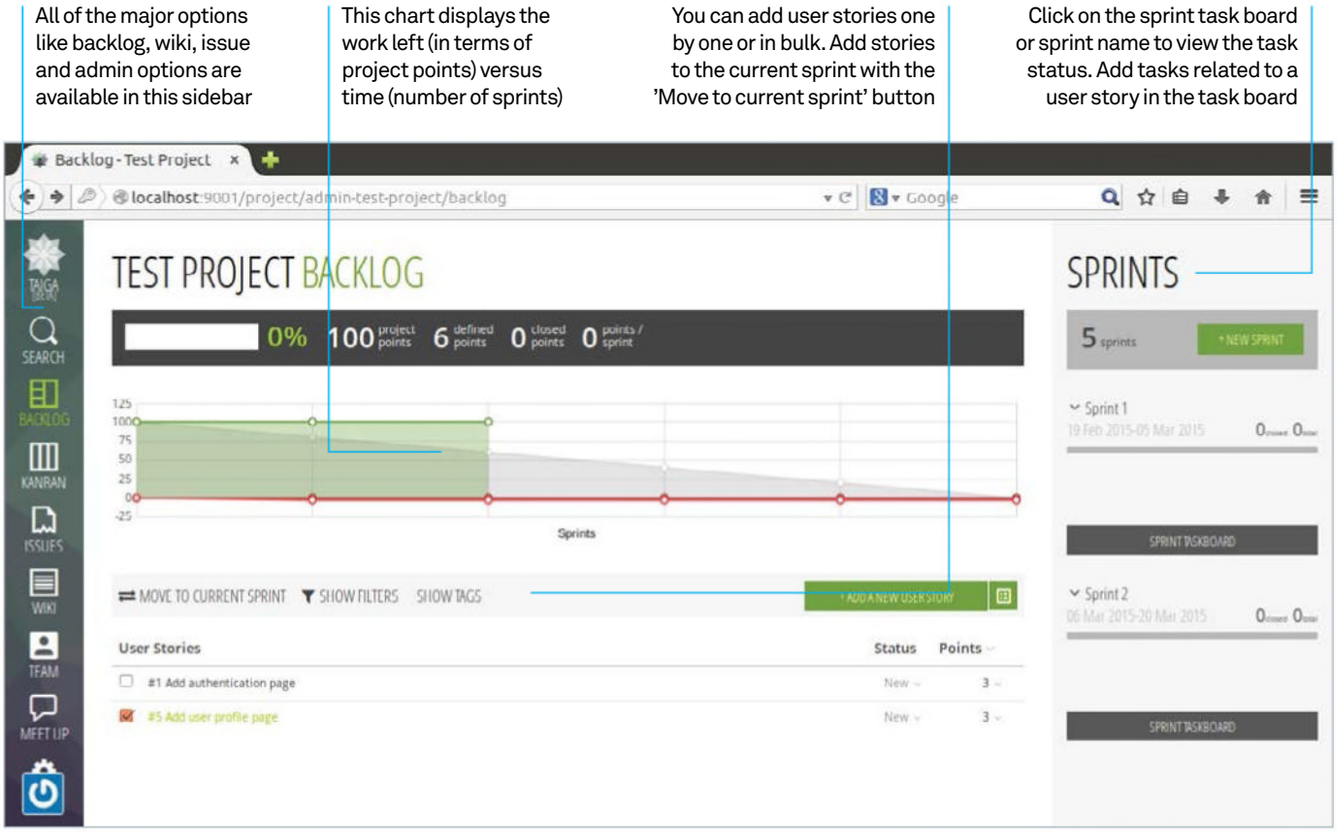
The only drawback of the style is that it needs to have at least two lines of text to look pleasant on the page.

16 How it worked

Our example book was built step-by-step: a minimal book.tex file was generated first, then chapter and appendix files without any data were added to the project.

At this point it was time for us to write the book by adding text, images, tables, bibliography and index entries, while experimenting with the look of the existing LaTeX styles, making changes to them, adding new ones and correcting errors.

This is definitely the safest procedure to follow when writing your own book while using LaTeX – LaTeX was able to process all the files, as well as the index and the bibliography, without any difficulties. So go on and make your own creation!



Implement agile project management with Taiga

Software projects are hard to manage but Taiga is a great alternative to old PM tools

Software has found its application in almost everything we use in our daily lives. But software development has its problems, a major one being measurement – its intangible outputs prove difficult to manage. A task may seem easy but it's hard to judge what issues you may face when coding, especially if it's a distributed architecture with several components. So, how can you overcome this?

This question was answered with the advent of agile development methodology. Agile methodology focuses on the end product, but there is a dearth of good open source, agile-focussed tools – most of them are old, simply tweaked to support agile. That was until Taiga. Taiga is an open source, agile-based PM tool. Named after a forest biome, it aims to be at the centre of an ecosystem – your projects and your team – with its new UI and agile-based layout.

Let's start this tutorial with its installation on Ubuntu 14.04 and then go on to see its internals. The installation here is for a development server. There is a different production server installation process on the Taiga website.

Resources

Taiga home page taiga.io



01 Installation

Taiga has three main components that need to be installed separately.

- Taiga-back: The backend part (also supports the APIs).
- Taiga-front: The frontend part.
- Taiga-events: Web sockets gateway. Completely optional and not required for general project management purposes. We'll skip this section.

Before we get going with the web frontend, we need the backend running. Taiga's backend has several dependencies like development headers, C compiler and other packages. First, run the below commands to install all the dependencies:

```
sudo apt-get install -y build-essential
binutils-doc autoconf flex bison libjpeg-
dev
sudo apt-get install -y libfreetype6-
dev zlib1g-dev libzmq3-dev libgdbm-dev
libncurses5-dev
sudo apt-get install -y automake libtool
libffi-dev curl git tmux
```

Taiga uses PostgreSQL 9.3+ as the database, so install the database:

```
sudo apt-get install -y postgresql-9.3
postgresql-contrib-9.3
sudo apt-get install -y postgresql-
doc-9.3 postgresql-server-dev-9.3
```

Now set up the initial user and database. This command will create a user called taiga and then a database name taiga under the user taiga:

```
sudo -u postgres createuser taiga
sudo -u postgres createdb taiga -O taiga
```

02 Taiga-back installation

Now let's set up the Python environment. You also need to install virtualenvwrapper – a set of extensions that make sure your system isn't clogged with third party libraries by running them in an isolated virtual environment.

Run the following commands to install Python and virtualenvwrapper. Then restart your shell to reload the bash with the virtualenvwrapper variables and functions.

```
sudo apt-get install -y python3 python3-
pip python-dev python3-dev python-pip
virtualenvwrapper
sudo apt-get install libxml2-dev libxslt-
dev
```

Download the Taiga backend code from GitHub and run the commands below. The current directory will change to 'taiga-back'.

```
cd ~
git clone https://github.com/taigaio/taiga-
back.git taiga-back
cd taiga-back
git checkout stable
```

Create a new virtualenv called taiga using the following command:

```
mkvirtualenv -p /usr/bin/python3.4 taiga
```

Then install dependencies for the backend:

```
pip install -r requirements.txt
```

Next, populate the database with some sample data; this will also create a user admin with password 123123:

```
python manage.py migrate --noinput
python manage.py loaddata initial_user
python manage.py loaddata initial_
project_templates
python manage.py loaddata initial_role
python manage.py collectstatic --noinput
python manage.py sample_data
```

Now you will be able to run the server. Remember, however, that the workon command enables the taiga virtualenv:

```
workon taiga
python manage.py runserver
```

Once you're done and have completed this step correctly, you should be able to view a JSON that will represent the complete list of endpoints via this address: http://localhost:8000/api/v1/.

03 Taiga-front installation

For the next step, let's complete the Taiga frontend installation. Taiga uses various programming languages other than the usual CSS/HTML/JavaScript in the frontend, so it really needs to be built before your browser can fully understand it.

Download Ruby and Gems. After setting the path with the last command, restart the shell with the following:

```
sudo apt-get install -y ruby
gem install --user-install sass scss-lint
export PATH=~/.gem/ruby/1.9.1/bin:$PATH
```

Now complete the NodeJS installation with:

```
sudo apt-get install -y nodejs npm
```

Then you will have to run the **node** command to check if the command is recognised. If this isn't the case, you should run:

```
sudo ln -s /usr/bin/nodejs /usr/bin/node'.
```

Now install gulp and bower:

```
sudo npm install -g gulp bower
```

...then get the code and compile taiga-front:

```
cd ~ git clone https://github.com/taigaio/
taiga-front.git taiga-front
cd taiga-front
git checkout stable
```

Compile using:

```
npm install
bower install
```

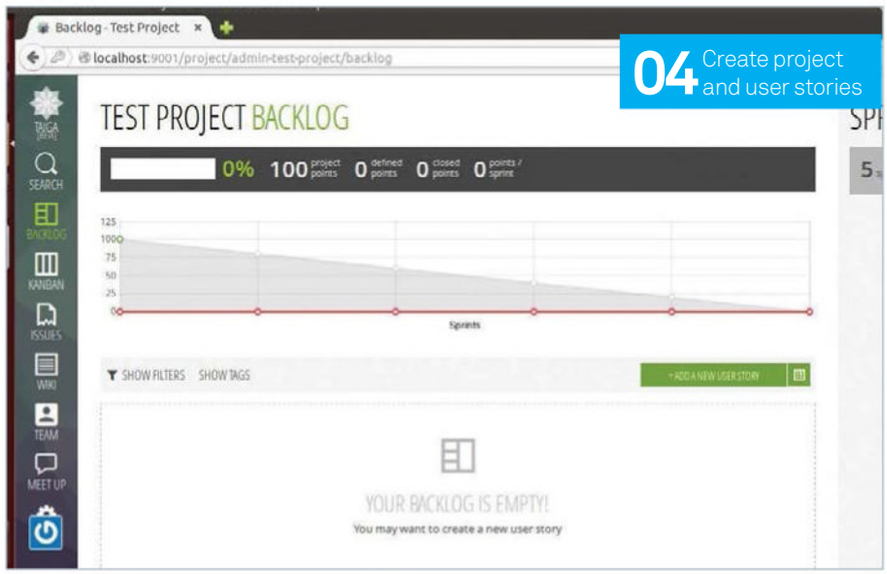
Now run gulp:

```
cd ~/taiga-front
gulp
```

If you find that you have npm errors while running gulp, clear the temp files and install all dependencies again.

```
rm -rf ~/.npm; rm -rf node_modules
npm install
bower install
gulp
```

If it is successful, you should now be able to see Taiga at **http://localhost:9001.**



"Sprints have predefined time slots, usually two to three weeks"



04 Create project and user stories

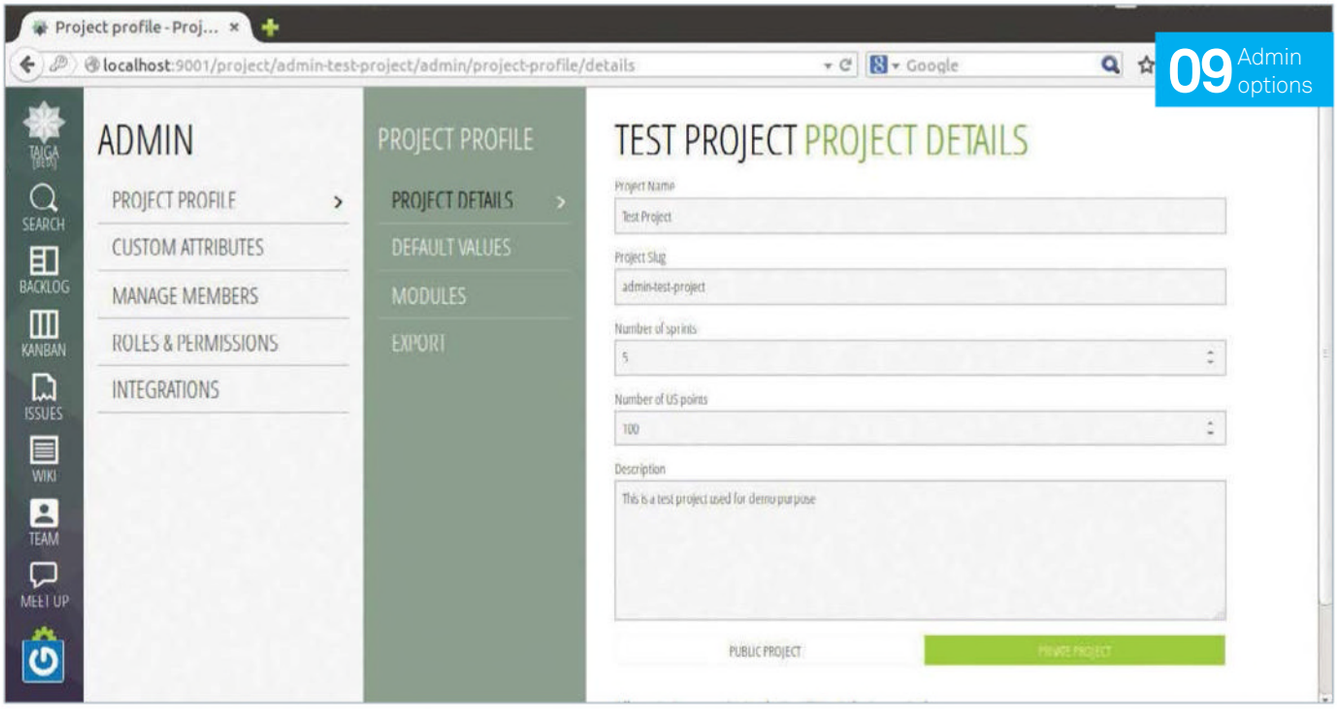
With Taiga now running in your browser, the next step is to create a project. We already have the admin user created with the password 123123, so log in to Taiga with the credentials and click on Create Project. Then select the Scrum template and click Next. Finally, fill in the relevant details (name and description) and click Create. This will take you to the Project Backlog page. On the upper half of the page you have the burn-down chart and the lower half has the user story list. On the right sidebar, you can see the Sprints section. As is generally done, let's start with creating user stories, since the uninitiated, agile development methodology requires software features to be broken down into smaller units based on a user's point of view. These units are called user stories in agile jargon.

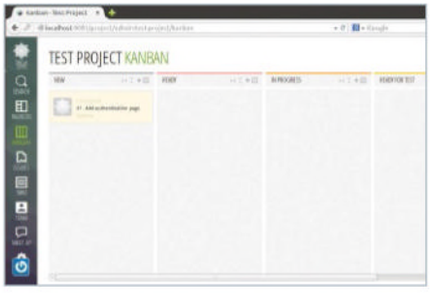
To add a user story, just click 'Add a new user story' in the lower half of the page. On the next page, fill in the details. Note that you can assign project points to the user story via this page. You can also add several stories at once using the bulk insert button (next to the 'Add a new user story' button), and do not forget to change your admin password to something memorable!

05 Create sprints

Now that the user stories are available, let's plan the sprints. As you may be aware, sprints are predefined time slots, usually two to three weeks. Before a sprint starts, developers commit a set of user stories to be finished by the end of the sprint. When the sprint is over, scrum master takes stock of the situation and decides the user stories for the next sprint, and this cycle continues.

To create a sprint in Taiga, just click the New Sprint button on the right sidebar. On the next page, fill in the name and the duration of the sprint. By default, sprints are of two weeks – the start and end date gets filled automatically. Since you have already added user stories, just go to the backlog page, select the relevant user stories and click the 'Move to current sprint' button. Thus you can have stories assigned to the sprint and the rest of the stories available as backlog. Once you have user stories assigned to sprints, you can further break it down to dependent tasks.





06 Kanban template

Kanban has its roots in Japan. It uses a work-in-progress system as the core mechanism to expose system operation (or process) problems and stimulate collaboration to continuously improve the system. While traditionally used in manufacturing, it is now widely used as a variation of agile methodology.

With Taiga you can either create a project with the kanban template or view the kanban template inside the scrum template. To create a simple kanban project, just select kanban during project creation. If you want your project to be viewable as both scrum and kanban, create the project under a scrum template and then enable kanban under Admin>Project Profile>Modules>Kanban. Now you will have a kanban option on the left-hand sidebar. Click here to view your scrum project in a kanban template.

07 Issue management

Another important aspect of software development is the issue management. Taiga offers a comprehensive issue management system that includes bugs, questions and enhancements. To raise an issue, click on the Issues link on the left sidebar. Then click on the New Issue button in the top-right corner. Fill in the details like the type, priority, severity and so on, and then click Create. You can now see the issue in the Issues list but it is still not assigned to anyone. Click on the Unassigned button to assign it to a team member. Note that the left sidebar has different filters available to use as well. Click on a filter to view relevant bugs. You can also search issues using the search box on the top-left sidebar.

08 Wiki

With Taiga at the helm, software documentation is taken care of as well. You can see the Wiki link on the left sidebar below the Issues link, so just click on the link to get started. You can see the WYSIWYG interface text editor. Add the text in the editor and once done, click the Add Link button. Here you can assign the name to the wiki page. Once the name is assigned, you have your first wiki page ready. You can add other pages similarly and even link pages among themselves as required.

09 Admin options

View the admin options (gear icon) in the bottom-left corner. These settings are specific to projects, so you can have different settings for different projects. There are five major ones under the admin settings. 'Project profile' lets you set up project details, enable/disable modules and more. 'Custom attributes' lets you create a custom status for issues, priorities and statuses. 'Manage members' and 'Roles & permissions' have options for user/privilege management. 'Integrations' merge the project with GitHub, Bitbucket and GitLab, and sync events with Webhooks.

10 Gamification

If you didn't notice at this point in the tutorial, there is a fair amount of gamification added to Taiga in a very subtle, unobtrusive way. Take the iocaine dose, for example. While you edit a task related to user story during a sprint, you are able to click on the Iocaine button to indicate to others that you are stretching to finish the task.

There are other features planned too – for example, the poker planning module that lets your professional team negotiate on the time that could be required for the task at hand, and the kudos badge to encourage some positive communication amongst the team.

Make a visual novel game with Python

Bridge the gap between books and videogames by creating an interactive novel with Python and Pygame



Change scenes to add more depth to the story, and allow the game to have decisions and routes

Resources

Python 2:
www.python.org/

Pygame:
pygame.org/download.shtml

IDLE Python IDE

Game assets

Code from FileSilo (optional)

Most people look for a compelling story in modern videogames, and those that don't have one are appearing less and less. A great way to tell a pure story is through the genre of visual novels, and you can make one fairly simply in Python. These interactive novels are an extremely popular form of entertainment in Japan, and usually work by having the player click through a story and make decisions as they go along in order to experience different plot points and endings.

In Python, this is a relatively simple project to create, but with the addition of the Pygame module we can make it easier still, and even more expandable for the future. Pygame adds better support for positioning the images and text, creating display windows and using mouse and keyboard inputs, thereby simplifying the coding process.

We'll be coding this in standard Python 2, so make sure to run it in IDLE 2 and not IDLE 3 while you are writing, testing and coding.

01 Get Pygame dependencies

The best way to install Pygame for your system is to compile it. To do this you need to first install the right dependencies. Open up the terminal and install the following packages, which in Ubuntu looks like:

```
$ sudo apt-get install mercurial
python-dev python-numpy libav-tools
libsdl-image1.2-dev libsdl-mixer1.2-
dev libsdl-ttf2.0-dev libsmpeg-
dev libsdl1.2-dev  libportmidi-dev
libswscale-dev libavformat-dev
libavcodec-dev
```

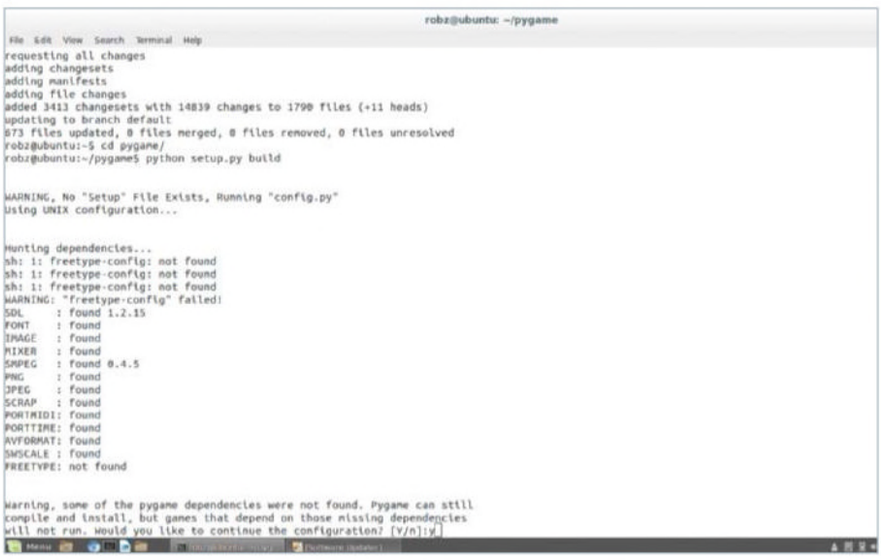


02 Get the Pygame code

Next we need to download the code for Pygame direct from the source. Still in the terminal, you can do this by typing in:

```
$ hg clone https://bitbucket.org/pygame/
pygame
```

Which will download it to the folder 'pygame'. Move to that using CD pygame in the terminal so we can continue building it.





03 Build the Pygame module

To install it, we need to do it in two steps. First we need to prepare the code to install using the terminal with:

```
$ python setup.py build
```

Once that's finished you can then actually install it with:

```
$ sudo python setup.py install
```

This won't take too long.

04 Install in other ways

If the above doesn't work (or is a bit daunting) you can check the website for binary and executable files that will work on other operating systems and Linux distros. Head to **http://pygame.org/download.shtml** to get the files you need for your specific system, including Windows and OS X. The rest of the tutorial will work in any OS.

05 Get the visual novel files

We've uploaded the code to FileSilo, and here we're going to walk you through what we've done to make it work. Download the files for the visual novel and unzip them. The two files we care about for the moment are the visualnovel.py and script.py python files – this is where all the important code is.



06 Understand the script file

For the moment the script file is small and literally just holds the script for the game. It's made up of events for the visual novel to move between, line by line, by splitting it up into scenes. This includes the location of each line, the character, the actual line itself and information on how the game flows. These are matrices with the information in, and are completely customisable.

07 How the script relates

In our game, the code pulls in elements from the script file as it goes. We'll explain how that works later, but this also allows us to implement decisions later on to change which direction the game might take you in.

```
import pygame, time, script
pygame.init()
```

08 Starting the main game

We don't need many modules for the current state of the visual novel. Here we've imported the new Pygame module, our script as a module and the time module for aesthetic reasons – we're going to have the code pause in bits rather than just instantly change scenes to the next line. We also initialise Pygame with a simple pygame.init()

09 Add variables and assets

We add a mixture of information to run the novel. Define the size of the display (1000 pixels wide, 563 high), along with RGB colours for the code to use. We're also telling Pygame what font to use and how large for certain sections and also loading images for the game.



10 Start the game

Create a display for the game. Pygame works by constantly updating the display with new information. To show how this works, the menu function adds elements to the display (which we've titled screen), such as filling it with colour, adding shapes and using blit to add images or in this case text. Once you've created a buffer of changes to the screen, you update it with the flip() function.



11 See the mouse

As we've created the button as a rectangle and now an image on the menu, we need to recognise when the mouse is hovering over it to know when the button is clicked. First we have to use event.get() to see the mouse in general, then we look for the position with get_pos(). After that, we wait for it to click, see where it clicked (using the co-ordinates of the rectangle) and make a decision after that.

```
def start_game():
    global game_script, location, character
    turn = 0
    game_state = 1
```

12 Start the story

Our start_game function is called when the mouse clicks the right position and we prepare the game, getting the characters, locations and progression through the game script. The rest of this function uses this info to pull in data from the script to make the game flow properly.

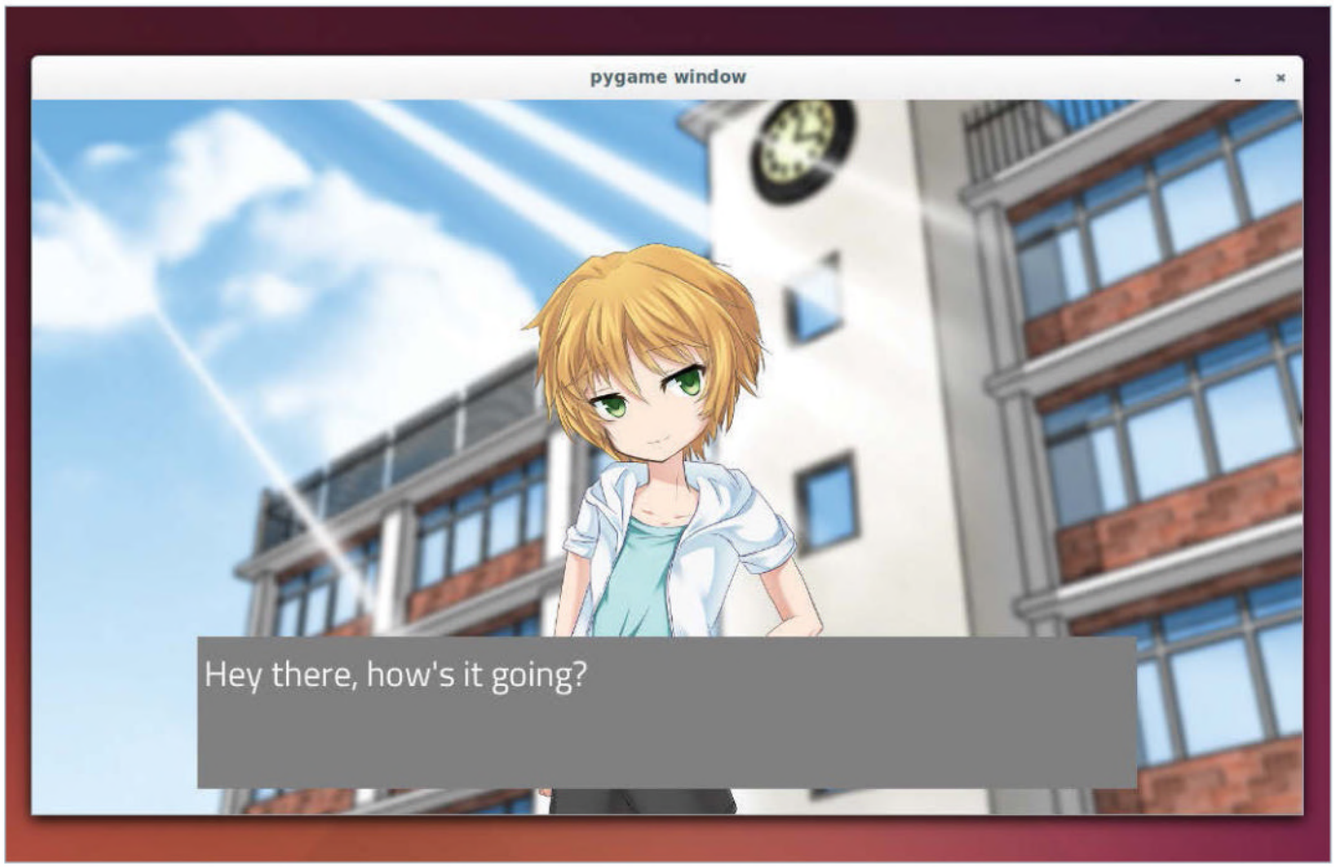
13 First screen

The first screen is handled differently, and acts to get every element up on the interface before we continue – it makes the code take a little less time to process as we

"The code pulls in elements from the script file as it goes"

```
elif turn > 0 and click_state[0] == 1:
    line_start = 0
    for i in range (4):
        if line_start == 0 and line[0] != '0':
            print line[0]
            screen.blit(location[line[0]], [0, 0])
            time.sleep(1)
        elif line_start == 1 and line[1] != '0':
            screen.blit(character[line[1]], [377, 113])
            time.sleep(1)
        elif line_start == 2:
            pygame.draw.rect(screen, (grey), pygame.Rect(130, 423, 740, 120))
        elif line_start == 3:
            screen.blit(game_font.render(line[2], 1, white), (135, 430))
            turn += 1
            if  line[3] != '0':
                game_script = line[3]
                time.sleep(0.5)
            game_state = line[4]
            clicked = 0

        line_start += 1
        pygame.display.flip()
```



begin. The getattr allows us to use the string/integer associated with our place in the story and call upon the relevant scene function from the script file. We then use an if statement with an iterative function to successively add screen element to give the illusion that it's building up the first screen. We finish it by advancing the progression value.

```
def game():
    global game_running
    while game_running == True:
        menu_screen()

game()
```

14 Add variables and assets

Similarly to the way that our original startup code works, our next if statement and iteration checks to see what is different on the next line, and if it moves to a different scene function. It will also change anything that is different without filling up the buffer more than needed. Where we've made no change is labelled with a 0 in the scripts.

"The code here is very expandable, allowing you to add decisions that take you to different scenes"

15 The starting function

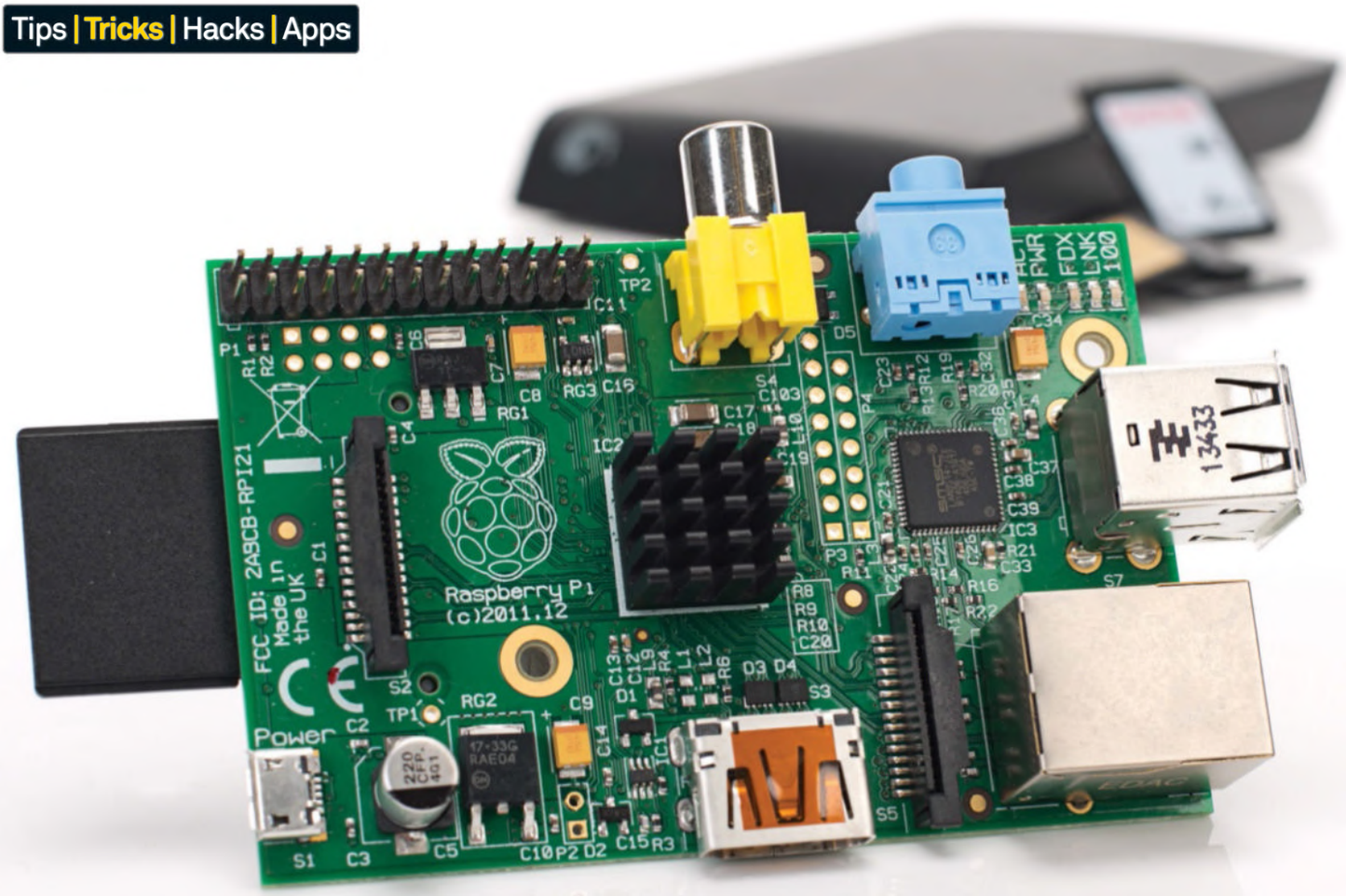
We finish our code bit with a simple function that starts off the entire game. This is just to encapsulate the entire code and allows us to add different ways of turning it off in the future. IDLE when running the file will load everything up and then run the game() function at the end – this is similar to how you can add a __main__ function at the end which will start the code in the command line.

16 Expand your code

The code written is very expandable, allowing you to add decisions that are logged to take you to different scenes (or 'routes', in visual novel terminology) and make your game feel even more interactive. This would not require the addition of very much more code than the if statements, and it would also be a good opportunity for you to look into adding in some graphical buttons to click and use the collide function.

17 Move the assets

Currently the code has the script-specific assets stored in the main visualnovel file. These can be moved over to the script, which will allow you to make the visualnovel file significantly more modular. This means that you can then have multiple scripts with different assets that will load at startup. With the basic game done, enjoy playing!



Supercharge your Raspberry Pi

Get the most out of your Raspberry Pi with these performance-enhancing tips and tricks

Your Raspberry Pi is plugged in. Raspbian is installed on the SD card and you are right in the middle of setting up a wireless print server or building a robot to collect your mail from your doormat.

But are you truly getting the most from your little computer? Do the components you're using maximise the potential of your Raspberry Pi or are they holding it back? Perhaps you haven't explored the full set of options in Raspbian, or you're running the entire OS from SD card, something that can reduce SD card lifespan.

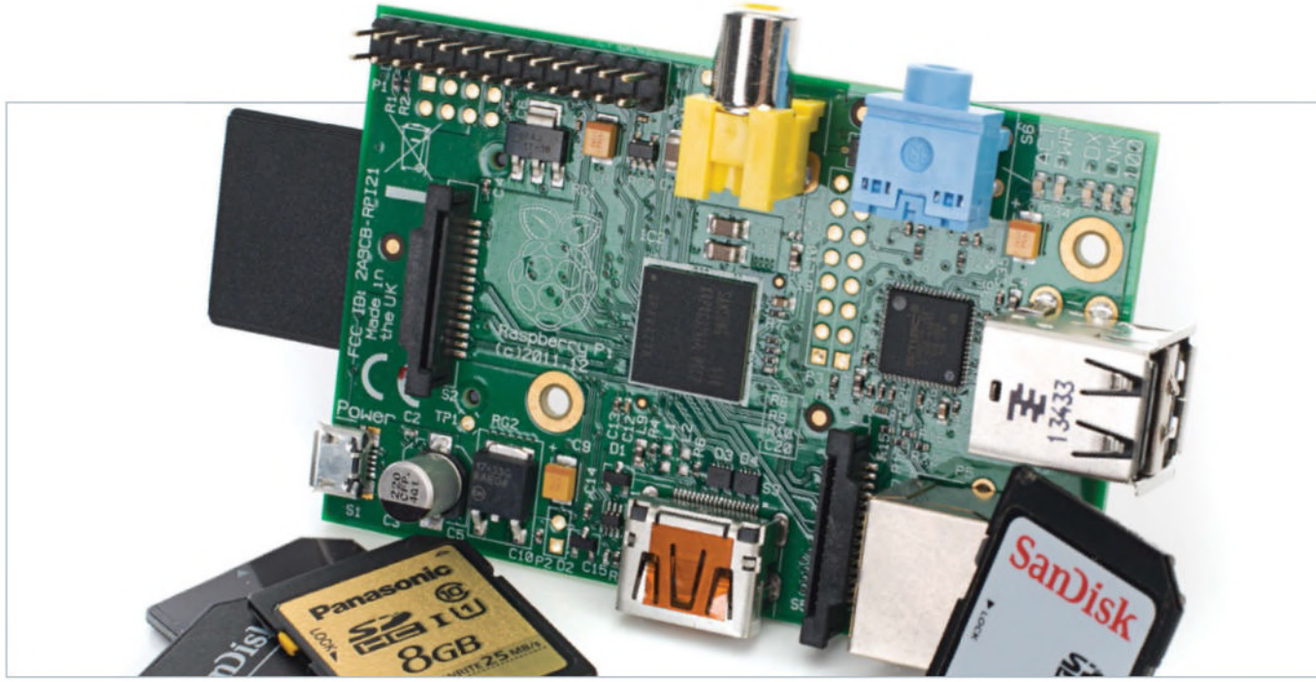
Various tools and techniques can be employed to improve performance, from choosing the right hardware to overclocking the CPU. You might even maximise storage space on the Raspberry Pi's SD card or all but replace it with a secondary device to help improve speed.

Use these tips and tricks to reconfigure your Raspberry Pi setup and optimise software and hardware to ensure you get the best performance for your projects.



01 Use better storage hardware

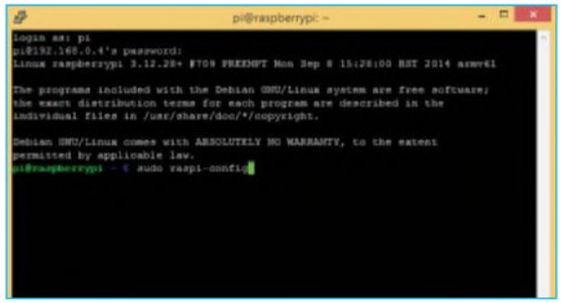
Your choice of storage media can have an impact on your Raspberry Pi's performance, regardless of the operating system. A low capacity SD card with poor error correction, is going to be slower than a larger card with greater resilience, so you need to find the right balance for your project and shop wisely.



Above There's a great guide to SD cards at **elinux.org/RPi_SD_cards**

02 Choosing the best SD card

Various standards of SD card are available, with the more expensive designed for better error correction. For the best performance on your Raspberry Pi, choose an SDHC card with a high rating. The same advice applies to MicroSD cards, which you can use on your Raspberry Pi with an SD card adaptor or directly insert into a Raspberry Pi B+.



03 Make the most of your storage

You'll typically need 1-2GB of storage for your chosen Raspberry Pi distro, so any remaining storage on your SD card will be used for updates and data you create or save.

In Raspbian you can open a command line and run the configuration utility to gain more space (only if your SD card's greater than 2 GB):

```
sudo raspi-config
```

04 Expand the Raspbian partition

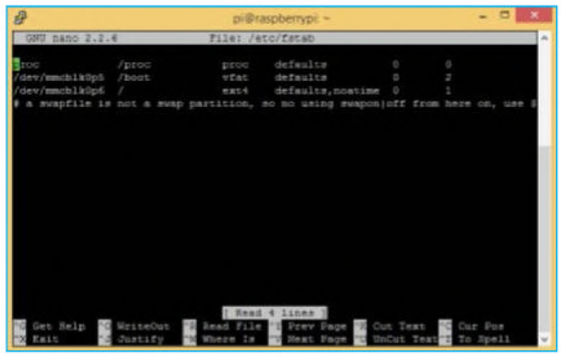
Maximising the partition affords the full capacity of your SD card, which will increase the media's lifespan (there is more space to write too, so the same sectors aren't being overwritten as often).

With raspi-config running, use the arrow keys to select expand_rootfs in the menu. Then wait briefly while the partition is resized.

05 Write data to RAM

Rather than reading and writing data to your SD card – something that will eventually result in a deterioration of reliability and performance – you can configure Raspbian to write to the system RAM, which will speed things up slightly and improve SD card performance.

This is achieved using fstab (file systems table), a system configuration available in most Linux distros.



06 Enable fstab in Raspbian

This is much like creating a RAM disk in Windows and is almost as easy to setup. In the command line, enter:

```
sudo nano /etc/fstab
```

Add the following line to mount a virtual file system:

```
tmpfs /var/log tmpfs defaults,noatime,nosuid,mode=
0755,size=100m 0 0
```

Follow this by saving and exiting nano (Ctrl+X), then safely restarting the Pi:

```
sudo shutdown -r now
```

Buy rated SD cards

It's all too tempting to boot up your Raspberry Pi with an image copied to an SD card that you just pulled out of your DSLR or phone. After all, they're all the same, right? The chances are that your chosen SD card was one that you had lying about when you bought your Raspberry Pi. It might be good enough but if you want the best performance, a high-rated SDHC card with plenty of space is recommended. Such media is inexpensive and can be bought online or in supermarkets. Just make sure you're buying a known brand!



Above Having your filesystem on a USB stick is great for backups as well as performance boosts

Picking an external USB drive

Speeding up your Raspberry Pi by migrating the root filesystem to an external USB drive is a start, but what sort of device should you use for the best performance? With a USB thumb drive you can add flash storage up to 16 GB without running into any significant problems (the larger the drive, the greater the current is required to read/write). Anything larger is expensive and unnecessary. If you're planning to use an external HDD, there are no power issues as it will have its own power supply. As ever, your choice should suit your project.

07 Configure fstab for fast performance

Upon restarting, the virtual file system will be mounted and /var/log on the RAM disk. Other directories that can be moved to RAM include:

```
tmpfs /tmp tmpfs defaults,noatime,nosuid,size=100m 0 0
tmpfs /var/tmp tmpfs defaults,noatime,nosuid,size=30
m 0 0
tmpfs /var/log tmpfs defaults,noatime,nosuid,mode=0755,
size=100m 0 0
tmpfs /var/run tmpfs defaults,noatime,nosuid,mode=0755
,size=2m 0 0
tmpfs /var/spool/mqueue tmpfs defaults,noatime,nosuid,m
ode=0700,gid=12,size=30m 0 0
```

Add each to /etc/fstab in nano.

08 Move your OS to a HDD

If you're concerned about the lifespan of the SD card, why not reduce your Raspberry Pi's reliance on it? Instead of using the SD card as a sort of budget SSD, change its role and add a HDD or USB stick to run the operating system, leaving the SD card for bootstrapping. This can give a marked performance boost to the SD card.

09 Back up the SD card

Begin by creating a copy of your Raspberry Pi's SD card. Shut down, remove the card and insert it into your desktop computer. In the command line, run:

```
sudo dd bs=4M if=/dev/sdb of=~/backup.img
```

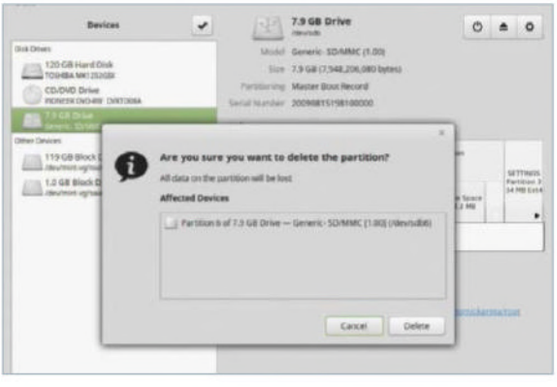
The path /dev/sdb represents the SD card. Copying should take 5-10 minutes. When complete, remove the SD card and connect your USB device.

10 Copy Raspbian to USB

Using a blank Ext4-formatted USB thumb drive (or external HDD) as the destination drive, enter:

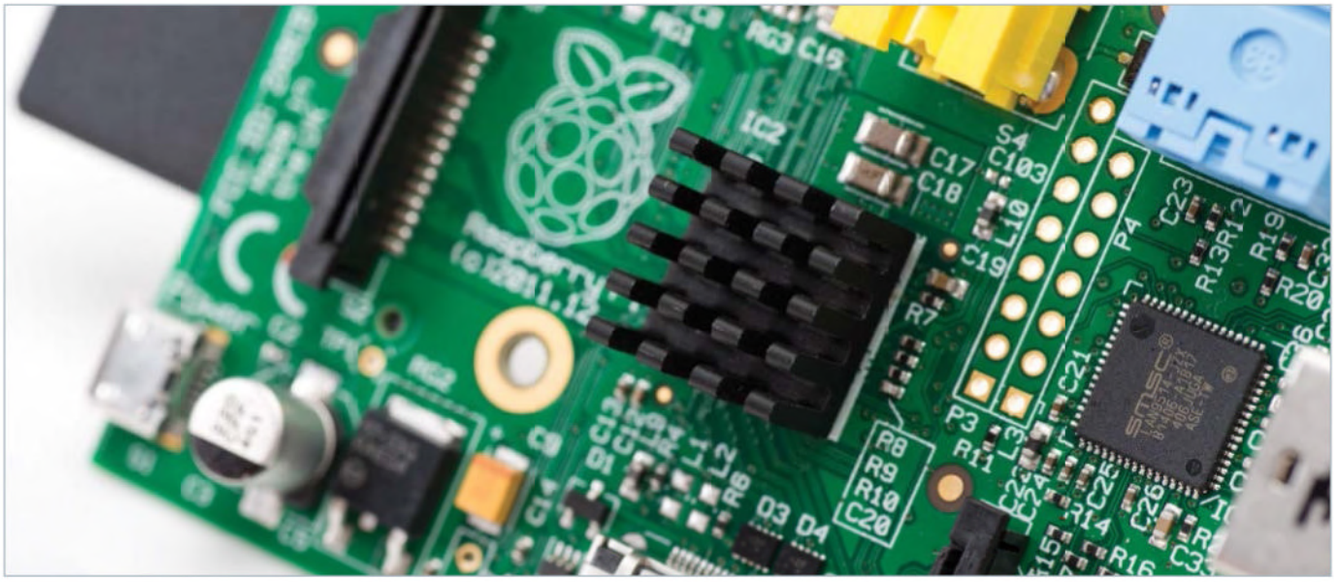
```
sudo dd bs=4M if=~/backup.img of=/dev/sdc
```

Leave the backup on your computer, just in case something goes wrong. With an SD card and USB storage device sharing an identical disk image, it's time to consider what you're going to do next – create a faster Raspberry Pi.



11 Split the Raspbian partitions

Ideally, the boot partition should remain on the SD card while the root filesystem is run from the external HDD or USB thumb drive. Using your preferred partition manager (Disk Utility is in most distros), unmount and delete the root filesystem from the SD card, ensuring you have retained the boot partition. After removing the SD card, connect your USB device and delete the boot partition, taking care to leave the root filesystem intact. Then resize the root filesystem on the USB device, making sure that 10 MB remains.



12 Identify the root filesystem

With this configuration you're going to have the SD card and the external USB storage connected, so you need to tell the Pi where the root filesystem is. Still on the desktop Linux computer with your SD card inserted, run:

```
sudo nano /boot/cmdline.txt
```

Find root=/dev/mmcblk0p2 (or similar) and change that to read root=/dev/sda2 which is your external USB storage. Save and exit.

13 Add other USB devices

You can now restart your Pi with the storage devices attached, but as soon as you connect further USB media you'll suffer problems. Avoid this by installing gdisk:

```
sudo apt-get update
sudo apt-get install gdisk
```

Then run gdisk:

```
sudo gdisk /dev/sdb
```

Enter ? to display the options and select Recovery and Transformation options (experts only), followed by Load MBR and Build Fresh GPT. Tap ? one last time and select 'Write Table to Disk' and exit. Remove and replace the USB device and run gdisk again. This time enter I and then 1 to display the Partition Unique GUID.

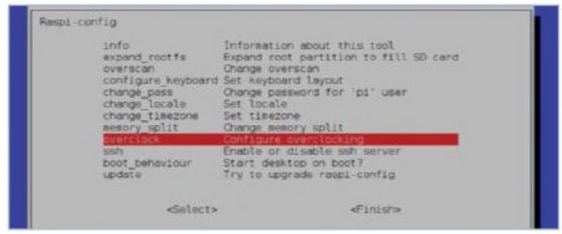
14 Make your Pi fast & reliable

Make a note of the GUID and then switch to the SD card. Reopen cmdline.txt and change root=/dev/mmcblk0p2 to root=PARTUUID=XXXXXX, where the numerical string from the partition unique GUID should replace the XXXXXX. When you're done, save and exit. You can then start your Raspberry Pi. Congratulations, your Raspberry Pi is now faster and more reliable to use!

15 Boost performance with overclocking

Need more from your Raspberry Pi? It is possible to overclock the computer, although you should be aware of the risks inherent with this activity. You should also ensure that your Raspberry Pi's processor is suitably cooled – heatsinks for the CPU, Ethernet controller and power regulator can be purchased online.

Above Heat sinks for the Pi are widely available and usually cost less than $10



16 Overclock your Raspberry Pi

Overclocking is available through raspi-config. Launch from the command line and arrow down to the overclock option. Four further options are available: Modest, Medium, High and Turbo. With your ideal clock speed selected, exit raspi-config and restart your Raspberry Pi to apply:

```
sudo shutdown -r now
```

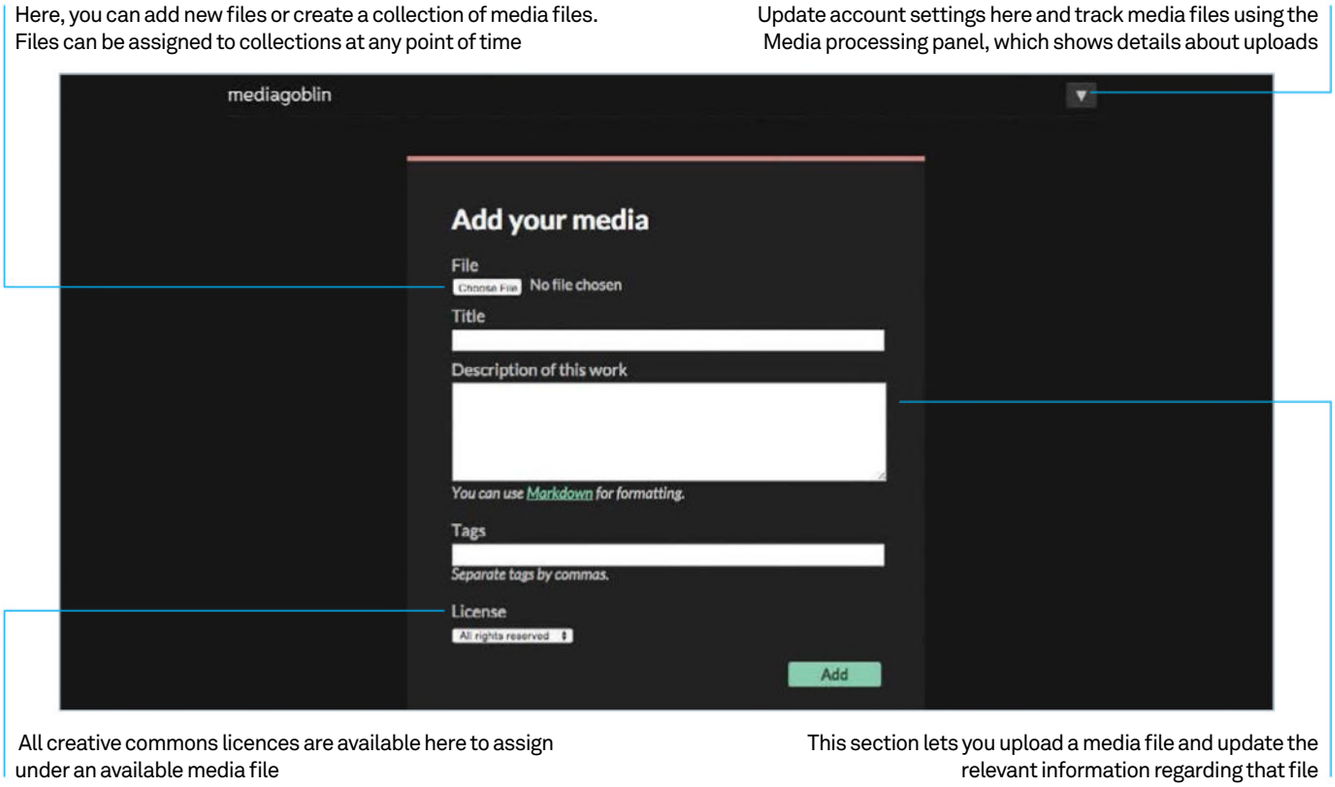
Now you will need to perform tests to see how stable it is overclocked. Raspberry Pi founder, Eben Upton, suggests running *Quake 3* as a good stress test. Should the Pi fail to boot, hold Shift to boot without overclocking, run raspi-config and select a more modest overclock.

17 Run Raspbian without the GUI

Despite these changes, you may find that the GUI remains slow. If you find yourself running a lot of commands in bash, the best thing to do is disable launching into X. In raspi-config, choose boot_behaviour and select the first (default) option to ensure your Pi boots to the command line. Should you need the GUI, enter 'startx' in Terminal.

Overclock with a heatsink

Overclocking is potentially dangerous to any computer system, which is why it's great that the Raspberry Pi developers have included the facility in their approved operating system and allowed its use under warranty. If you're using this feature, heatsinks and water cooling systems are available for the Raspberry Pi to ensure you don't bake the CPU and RAM when in use.



Host your own media gallery with MediaGoblin

MediaGoblin provides a way to share videos, photos or audio recordings with your loved ones, without worrying about privacy

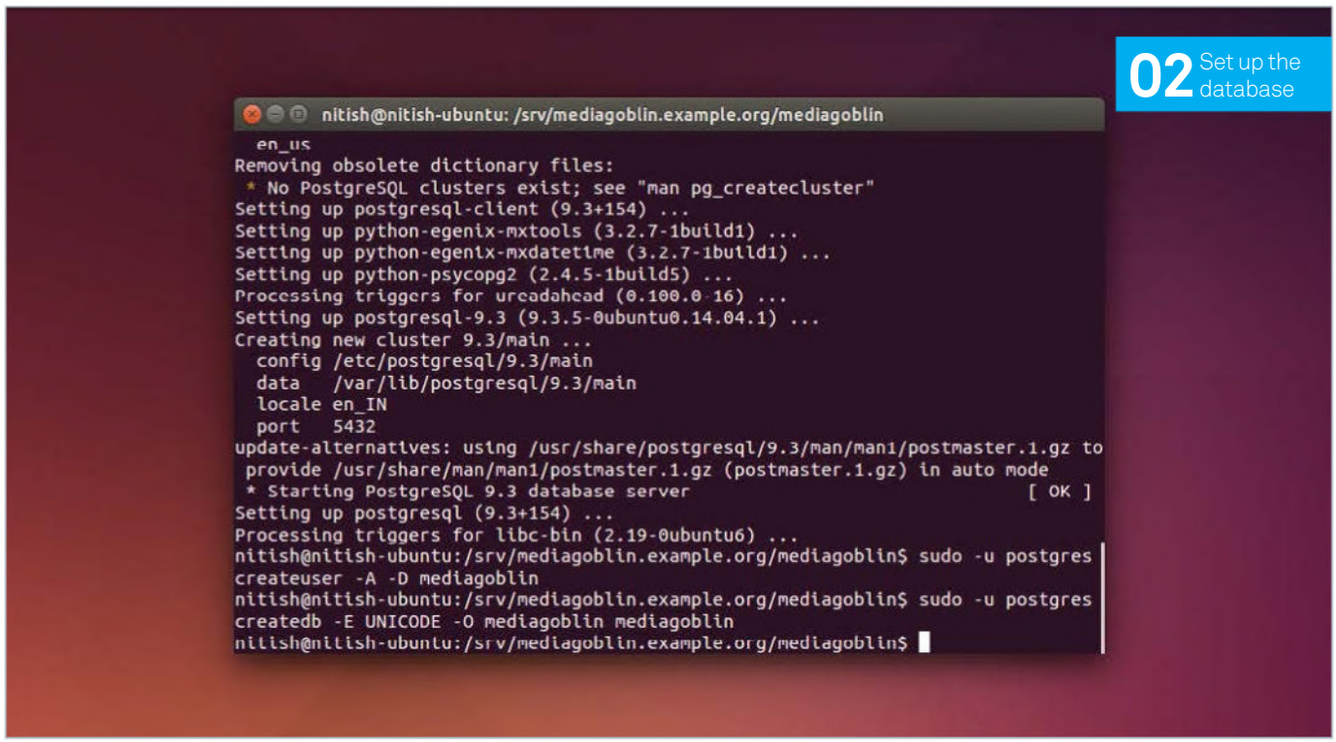
YouTube is not only a website anymore, it's become a phenomenon. Millions of hours are spent – or wasted – daily in watching videos of cats, dogs and humans doing strange things. With the predictive playlist appearing just after you finish a video, it is sometimes very difficult to close the window and you go on and on, watching one video after the other. But YouTube is a dangerous place for personal videos and other media that you don't want strangers to access. Though it has an option to make your videos private, you don't really know how private it is. So we need to find a solution that has the perfect match of convenience and privacy.

This is where MediaGoblin comes in. This open source tool can help you organise, host and stream media from your own PC without having to worry about privacy. If you are a power user, you can also have it run on a web server and let other people add their media. There are a range of other useful features available too, like tags and collections to name just two. In this tutorial, we will begin with the steps to install MediaGoblin on Ubuntu and then proceed to get it working and see it in action. We have used Ubuntu 14.04 as the host system and MediaGoblin's clone from their Gitorious repo.

Resources

MediaGoblin home page

mediagoblin.org



01 Sort out dependencies

MediaGoblin is a full-fledged media-streaming platform and therefore it has a few software dependencies that you will need to take care of before installing MediaGoblin. Let's take a look at these dependencies and how to install them.

Python 2.6 or 2.7 This interprets the MediaGoblin source code.
Python-lxml Binds certain C libraries to Python.
Git For downloading and updating the repository.
SQLite/PostgreSQL This is where everything is stored. SQLite is the default option and works fine for small set-ups, but you need to use PostgreSQL if you expect more users.
Python Imaging Library This adds image-processing capabilities to Python interpreter.
virtualenv This is used to create isolated Python environments.

You can install all these on a Debian based system, using the apt-get command. It can be done with a single command:

```
sudo apt-get install git-core python
python-dev python-lxml python-imaging \
python-virtualenv
```

02 Set up the database

As we said before, the default SQLite database doesn't perform well for deployments involving more than two or three users. So, if you are planning to have more than three users, it's recommended to use the PostgreSQL database. To set it up for MediaGoblin, first download and install the packages using apt-get:

```
sudo apt-get install postgresql
postgresql-client python-psycopg2
```

It has other required packages too. The installation process creates a user (postgres) with sufficient privileges to handle the database, but with security in mind we will create a separate user for MediaGoblin. To do this, type:

```
sudo -u postgres createuser -A -D
mediagoblin
```

Once the user is created, create the database:

```
sudo -u postgres createdb -E UNICODE -O
mediagoblin mediagoblin
```

Here the first 'mediagoblin' is the user name and the second is the name of database.

03 MediaGoblin user

If you followed along with the previous step properly, you'll have noticed that we didn't add in a password for the user named mediagoblin. So how does the system authenticate the user? This is done via the local Unix authentication. Local Unix authentication allows a system user to connect to any PostgreSQL database on the system without a password. To enable this, you need to create a system user with same name as the PostgreSQL database user.

So, what we need to do now is to create an unprivileged system user named mediagoblin. Note that the user can be underprivileged because MediaGoblin doesn't really need any special privileges to run. This also helps to make the system more secure. Run this command to create the user:

```
adduser --system mediagoblin
```

Since it doesn't have password, you can't login to this account but a switch is possible using:

```
sudo -u mediagoblin /bin/bash
```

Once created, you can then use this user account for all further steps.

04 Install MediaGoblin

To start the installation, you need to create a working directory for MediaGoblin. This is where the git repository will be downloaded. Create the directory using:

```
sudo mkdir -p /srv/mediagoblin.example.org && sudo chown -hR mediagoblin /srv/mediagoblin.example.org
```

As you can see, here we have created the directory with elevated privileges (root) and then change the owner to our underprivileged mediagoblin user.

Let's now clone the MediaGoblin repo to this folder. First, we'll switch to the mediagoblin user and then change the directory over to the working directory we have just created:

```
cd /srv/mediagoblin.example.org
```

Now start cloning:

```
git clone git://gitorious.org/mediagoblin/mediagoblin.git
```

Then move to the 'mediagoblin' folder created – `cd mediagoblin`. Initialise the repo and then fetch the data:

```
git submodule init && git submodule update
```

You'll notice that we didn't take code from the stable revision here but instead the master branch of the git repository.

MediaGoblin is under rapid development so it makes sense to use the master, at least until a consistent release.

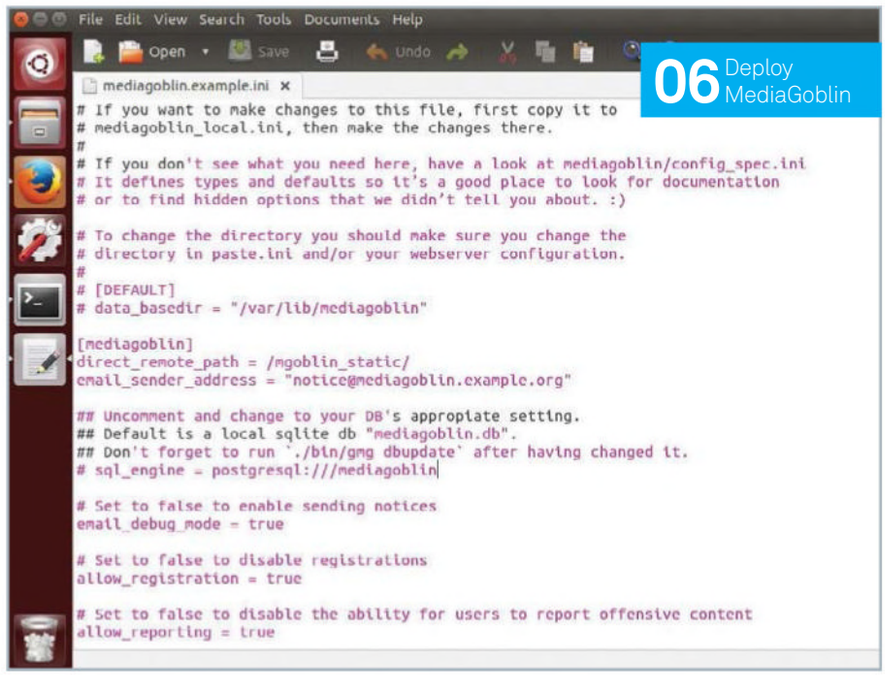
05 Install Virtualenv & others

MediaGoblin uses virtualenv – a tool to help manage the dependencies by creating isolated Python environments. It's already available in the package, so set it up by using:

```
(virtualenv --python=python2 --system-site-packages . || virtualenv --python=python2 .) && ./bin/python setup.py develop
```

If you are feeling adventurous, you can also try the experimental deploy system (shell script) instead of the earlier command:

```
./experimental-bootstrap.sh && ./configure && make
```



"MediaGoblin doesn't need any special privileges to run"

This script sets up virtualenv and also helps you keep it updated by running **make update**, but as per the developers of MediaGoblin, this is still under development and may break. To update the codebase at a later point of time simply run:

```
git submodule update && ./bin/python setup.py develop --upgrade && ./bin/gmg dbupdate
```

You also need to install Flup before the setup concludes. Install it using:

```
./bin/easy_install https://pypi.python.org/pypi/flup/1.0.3.dev-20110405
```

We will see more on Flup and FastCGI in the following sections.

06 Deploy MediaGoblin

Now that dependencies are set up and MediaGoblin is installed, we will edit the MediaGoblin configuration files – specifically the mediagoblin.ini file located inside /srv/mediagoblin.example.org/mediagoblin. Here are the changes required:

- Set `email_sender_address` as the ID you want to use for sending system mails.
- Uncomment the line `sql_engine = postgresql:///mediagoblin` if you are using PostgreSQL.
- Edit `direct_remote_path`, `base_dir` and `base_url` as per the root of virtual host.

Now update the database using `./bin/gmg dbupdate`. This populates the database with MediaGoblin data structures. Finally, test the MediaGoblin server using:

```
./lazyserver.sh --server-name=broadcast
```

You should now be able to connect on your browser port 6543.

07 Flup and FastCGI

MediaGoblin uses FastCGI for deployment and FastCGI needs a server. So we need Flup – a FastCGI server. We already installed Flup in step five, so lets now see why FastCGI is so important. Later you will learn a FastCGI setup with an Nginx server to serve MediaGoblin pages.

FastCGI is a protocol to interface interactive programs with a web server – it's an improvement over CGI (common gateway interface). CGI, while easy to implement, had problems in scaling since separate processes were created for each web request – a huge overhead for the host OS. FastCGI solves this by using persistent processes to serve series of web requests; moreover, these processes are owned by FastCGI server (Flup in our case) and not the web server. This de-couples webserver and FastCGI server, allowing effective scaling. Now any server that supports FastCGI can be used for MediaGoblin. Nginx is a good option because of easy configuration and setup.

08 Nginx setup

Nginx has been slowly rising in the ranks of the web server of choice and is currently one of the most used web servers. An acronym for Engine X, it is a high-performance HTTP server. It does support a lot of other protocols too but those are out of scope for us here. Let's go straight to the server set up. Create a configuration file at /srv/mediagoblin.example.org/nginx.conf and create a symbolic link into a directory that will be included in your nginx configuration with one of the following commands (as the root user):

```
ln -s /srv/mediagoblin.example.org/nginx.conf /etc/nginx/sites-enabled/
```

This way, a change in one file automatically reflects in the other. You need to then add the contents to the configuration file, as shown in the screenshot below. Remember to change the fields as per your local paths. Once done, restart nginx using `sudo /etc/rc.d/nginx restart`. If everything goes well, start MediaGoblin using:

```
cd /srv/mediagoblin.example.org/mediagoblin/ ./lazyserver.sh --server-name=fcgi fcgi_host=127.0.0.1 fcgi_port=26543
```

Visit **mediagoblin.com** to see an example MediaGoblin gallery in action.

09 MediaGoblin home

The setup process is a little lengthy, and for the novice user it may seem a complex task, but the steps are simple and you just need to follow them one at a time. Once you have successfully completed the process, you can enjoy uninterrupted media streaming for you and your loved ones.

08 Nginx setup

```
server {
  ##################################################
  # Stock useful config options, but ignore them :)
  ##################################################
  include /etc/nginx/mime.types;

  autoindex off;
  default_type  application/octet-stream;
  sendfile on;

  # Gzip
  gzip on;
  gzip_min_length 1024;
  gzip_buffers 4 32k;
  gzip_types text/plain text/html application/x-javascript text/javascript text/xml text/css;

  ######################################
  # Mounting MediaGoblin stuff
  # This is the section you should read
  ######################################

  # Change this to update the upload size limit for your users
  client_max_body_size 8m;

  # prevent attacks (someone uploading a .txt file that the browser
  # interprets as an HTML file, etc.)
  add_header X-Content-Type-Options nosniff;

  server_name mediagoblin.example.org www.mediagoblin.example.org;
  access_log /var/log/nginx/mediagoblin.example.access.log;
  error_log /var/log/nginx/mediagoblin.example.error.log;

  # MediaGoblin's stock static files: CSS, JS, etc.
  location /mgoblin_static/ {
     alias /srv/mediagoblin.example.org/mediagoblin/mediagoblin/static/;
  }

  # Instance specific media:
  location /mgoblin_media/ {
     alias /srv/mediagoblin.example.org/mediagoblin/user_dev/media/public/;
  }

  # Theme static files (usually symlinked in)
  location /theme_static/ {
     alias /srv/mediagoblin.example.org/mediagoblin/user_dev/theme_static/;
  }

  # Plugin static files (usually symlinked in)
  location /plugin_static/ {
     alias /srv/mediagoblin.example.org/mediagoblin/user_dev/plugin_static/;
  }

  # Mounting MediaGoblin itself via FastCGI.
  location / {
     fastcgi_pass 127.0.0.1:26543;
     include /etc/nginx/fastcgi_params;

     # our understanding vs nginx's handling of script_name vs
     # path_info don't match :)
     fastcgi_param PATH_INFO $fastcgi_script_name;
```

The first step after you're ready with your own MediaGoblin instance is to create an account. This is because you can browse the collections anonymously but you need an account to upload media. To create an account click on the 'Log in' button on the top-right corner. In the log in page that appears next, click on 'Create one here' to open the user registration page. Fill the details in the registration page and you are good to go! Just log in with the credentials and then click on your user name to be redirected to your profile page. Here you have the options to upload media and manage your profile.

10 Add media

Adding a media file is a breeze, just click on the 'Add media' button on the right side of your profile page. In the next page, upload the file, set the title of the media, add a description, add tags and set the license you'd like to assign to the media.

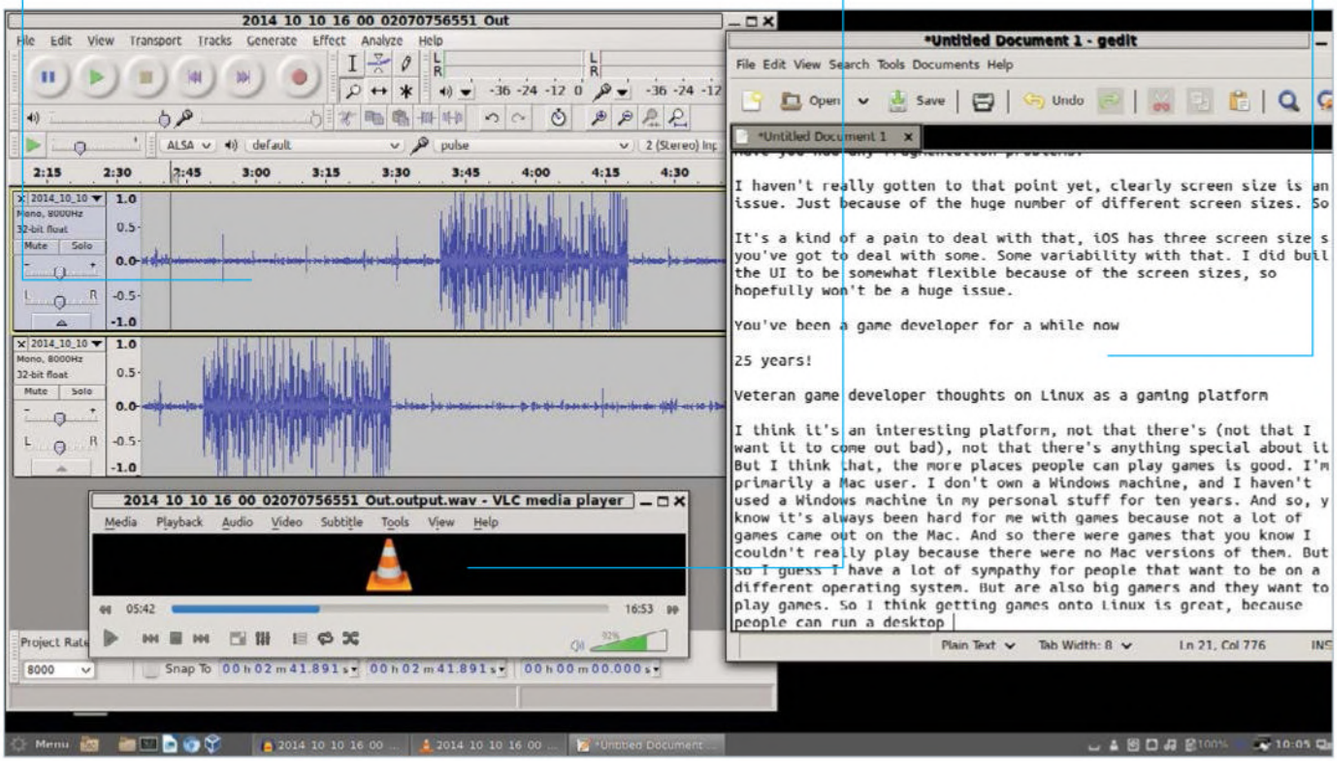
Finally click on the 'Add' button to upload the file. On the left-hand side of the page, you may notice that there is a 'Browse Collections' link. This option lets you browse through the collections that have been created by other users (if you are on a multi-user environment). A collection is a group of media files that are logically bundled together, generally with the intention of representing an event or other such scenarios. Note that media files can be added to these collections at any point in time and not just during the initial upload, so it's worth checking them periodically.

To create a collection yourself, click on the top-right icon to reveal the account related options and then click on 'Create new collection'. You can then add in the title and description to add your own collection.

Record your interviews and master your audio using Audacity to make it as easy to understand as possible

Configure playback to vastly improve control of your audio and make transcription slightly easier

Transcribe quicker and without leaving the text document by using global hotkeys to control the audio



Simplify interviewing and audio transcription on Linux

Make transcribing easier by following our guide through every stage

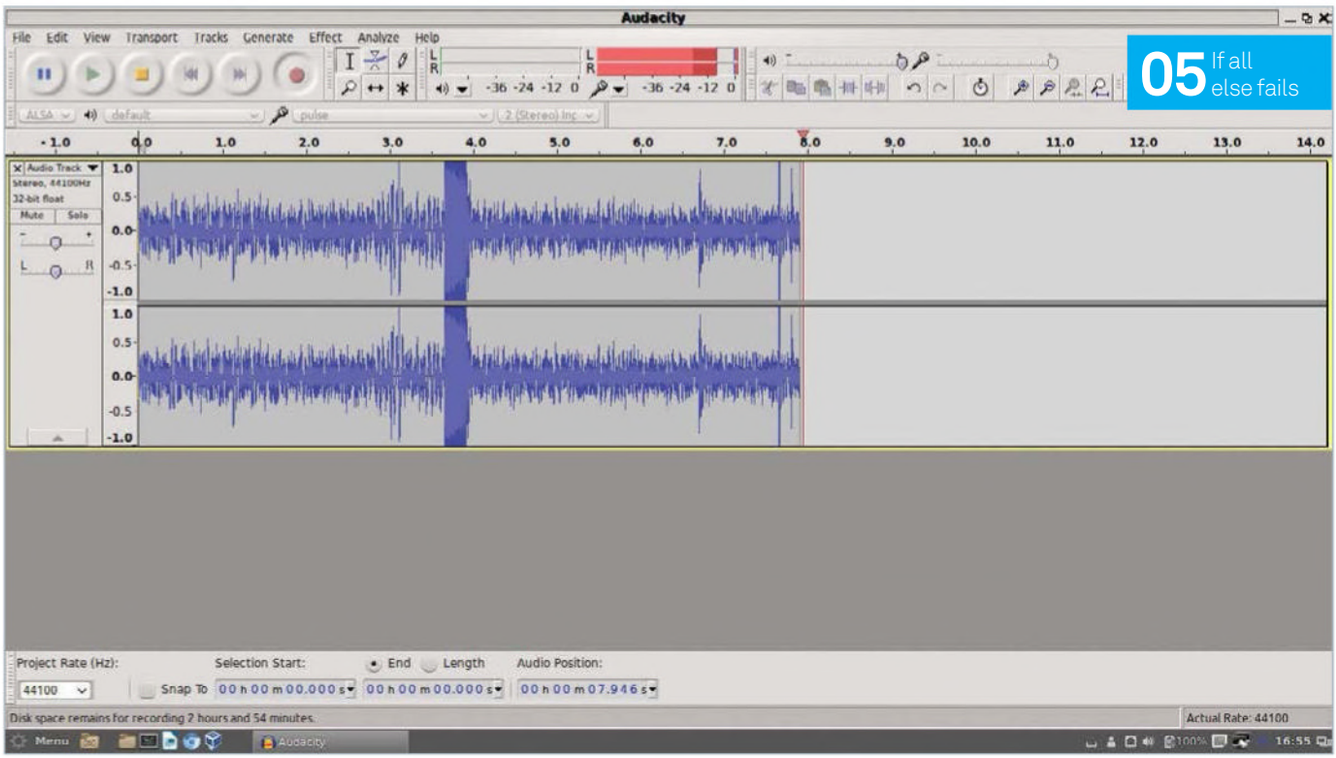
Transcribing is one of the most dull, joyless, time-consuming activities that we writers have to undertake. While we love to bring you some of the great interview content that can come out of it, the process of getting these words onto a text document is not our favourite thing.

Over the years, however, many of us in the press have perfected methods to make the job of transcription easier. On Linux, we can find some of the best and most customisable software, so actually getting a setup going for interviews can be really easy once you know how to do it.

While what we're talking about in this tutorial is aimed more towards interviewing, we have successfully adapted it for press conference use and there is no reason to see why you couldn't use it in lectures to make note-taking easier while at college or university. Are you ready? Okay, then let's go to the first Step.

Resources

Audacity audacity.sourceforge.net
VLC videolan.org/vlc



01 Choose an environment

The first thing you need to do is select your recording environment. Whether you're recording on the phone, on VoIP or in an open room, try and make sure you're in as quiet a place as you can be. While not always possible, when this can be controlled it's best to keep it in mind.

02 Gather equipment

You need a dictaphone and Android phone or a computer. The former are better for open situations, whereas for VoIP convos a dictaphone won't do much. We recommend to use your smartphone, so that you can you move the audio file to a PC for better transcription.



03 'Phone tap'

We have a device colloquially called a phone tap – it's a pick-up coil that attaches to the back of a phone receiver via a suction cup. Not very stealthy but excellent if you need to record an interview over the phone. These coils end in a 3.5mm jack that can be plugged into dictaphones or computers with a microphone in.

04 Record with VoIP

Depending on what kind of VoIP service you're using, you may already have some kind of recording function installed. Something like Skype won't have one installed but you can grab the Skype Call Recorder app instead.

05 If all else fails

If you need to record a call or audio on your PC, then you can manually record the full sound coming from your system using Audacity. You will need to have Pulseaudio as your sound server, select Pulse as the input in Audacity, start recording then go to volume control and select Monitor from the Capture drop-down menu.

06 Check equipment

It's a common mistake and it happens to everyone, but always check your equipment before doing the interview. One day the same setup will not work as you expected for some reason, and finding out after an hour-long interview is never fun.

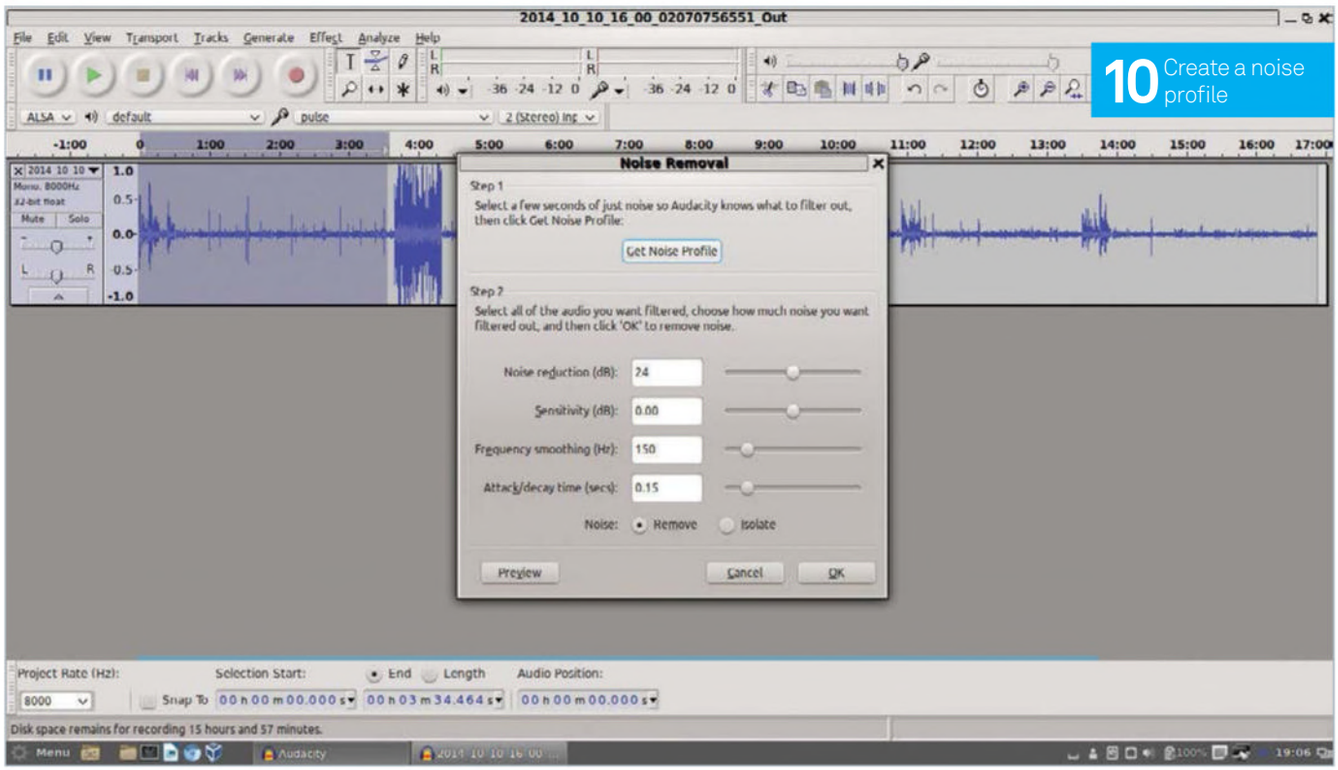
Android apps

There are a few Android apps that will record voice calls for you, however unless you're using a rooted device you won't be able to properly record the audio coming down the line from the caller. What a lot of them do is use the microphone to try and pick up what's coming from the receiver end of your phone. Experiment and find what is best for you, but otherwise you may have to look into rooting a phone to get the call recording to properly work.

07 In the interview

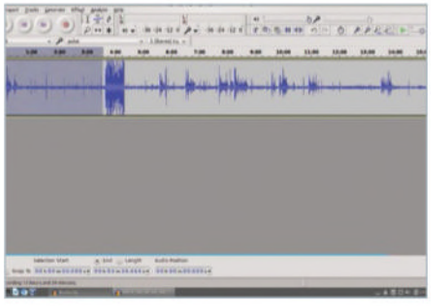
Taking notes on paper or with a note-taking application as you record can be useful for transcribing at a later point. Make sure you keep track of time stamps of interest so that you can easily find them when you are editing or listening back later.

This enables you to fast-forward straight to the parts of audio that you need when you're writing your article or typing up your notes. You can also do this in Audacity by hitting Ctrl+M while you are recording.



08 Transfer to PC

If you have recorded your interview on an external device, now it's time to move it to your PC. While dictaphones and some apps will have features that let you rewind and slow down playback – we can do it far better by having it unified on one system.

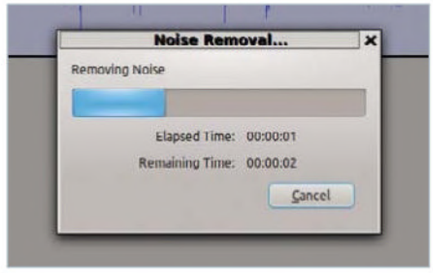


09 Clean up the audio

Before we start transcribing, we can do a few things to make the process slightly easier for ourselves. Import the audio into Audacity and, for now, trim the length and any breaks that you might have, so that you can gain a better understanding of how much there is to transcribe.

10 Create a noise profile

Before lopping off a quiet spot, you can use this to create a noise profile for the locale you're in. This can remove any background noise and make the interviewee slightly clearer. To select the quiet spot, go to Effect then Noise Removal and hit 'Get Noise Profile'.



11 Remove noise

Once the profile has been set, you can start to experiment with removing it from the track. Deselect the profile area and give it a quick try for the whole track and the default settings by going back to Noise Removal and hitting OK. You can select areas to remove noise from and change the settings to refine the removal if it helps.

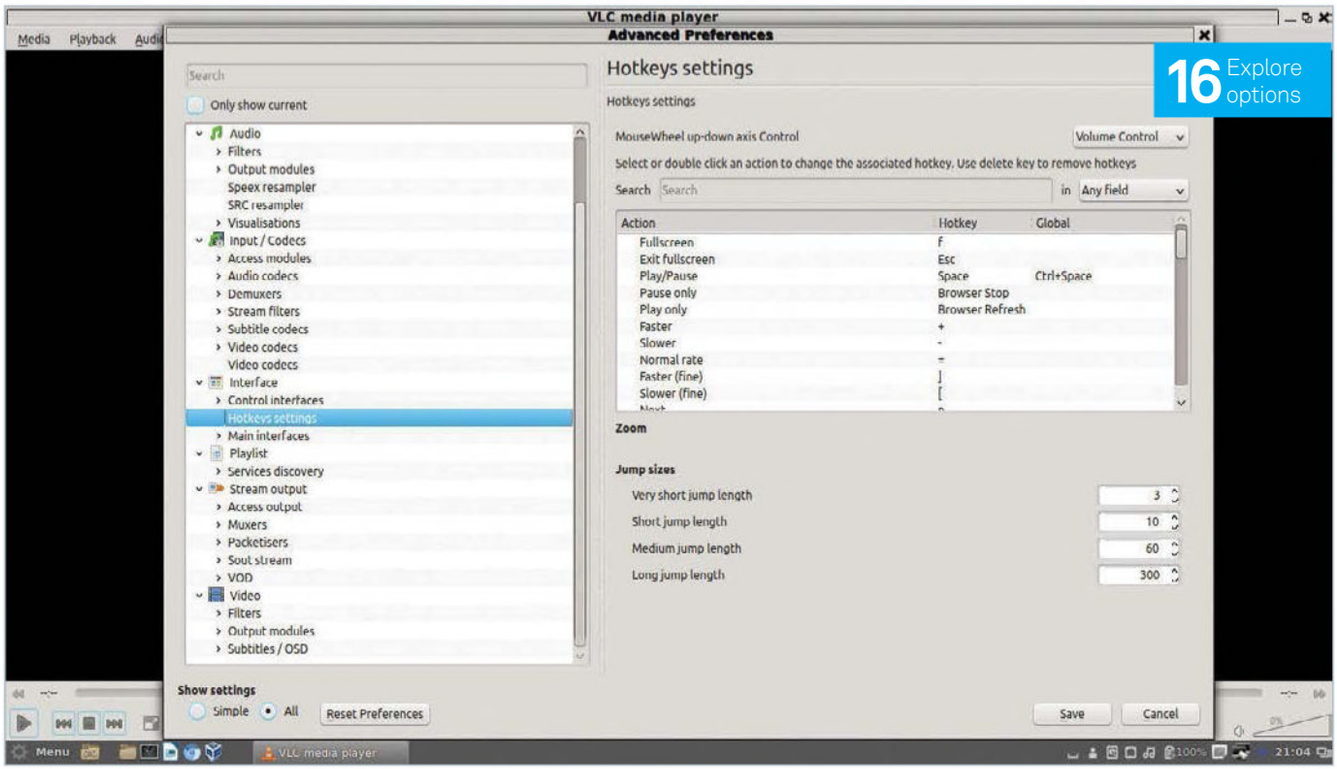


12 Amplify and normalise

You can look at trying to get a more consistent volume by amplifying different parts of the audio – especially if one side is consistently and noticeably more quiet than the other. Amplify can be found in the Effects menu. You may also have one side being far too loud – for this you can use Normalise to bring the volume down.

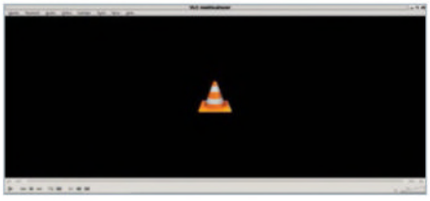
13 Mix down

Some recorders will put interviewer and interviewee on different sides of a stereo track. This can be extremely annoying if you need to leave one side of your earphones out, or if you're just trying to pick up words. On the track itself there's a drop-down menu where you can 'Split Stereo Track' and then turn each one into mono.



14 Export the file

Once you're done with the file, export it to your preferred file type. We'll be using VLC for the transcription stage, so you can use pretty much any filetype you can think of – although let's not try and test VLC at this stage, we want to make the process easier not harder.



15 Configure VLC

If you don't already have VLC, it's time to install it. We will make use of the global hotkeys for this part, which will enable us to control it from a different window. Once it's installed, open it up.

16 Explore options

Go to Tools on the menu bar and continue onto Preferences. At the Show Settings option, go to All to get the advanced settings up. Scroll down and look for the Hotkey settings option. Here's where the global key settings are found.

17 Set the hotkeys

The most important ones we find are play/pause and very short jumps back and forth. Double-click on the global key you want to set and then perform the key combo that you want to use. We like to use Ctrl+Space for pause and Ctrl+Right/Left for skipping – make sure that what you use doesn't clash with anything though.

18 Get set up

The moment of truth is almost here – get your word processor or text editor up and get ready to type. Close VLC, then open up the audio file and have it play. Go back to your document and try out your new global hotkeys – if all goes well, you can now skip backwards, forwards and pause without leaving the transcription.

19 Time to transcribe

You can start transcribing right now if you wish. One trick we use is to slow down the audio just slightly in VLC – you can do this by going to Playback, Speed and then clicking Slower. This reduces the speed down by about 25% and can usefully give you just a bit of extra amount of time to write something.

Machine transcription

The state of voice recognition on Linux is good – there are APIs and workable acoustic models that can actually parse what you're saying into sounds and such. The main issue right now is the lack of open language models – dictionaries full of words and common grammatical phrases. Unfortunately this means, for the time being, that there are no real FOSS solutions to machine transcribing that you can then fix later.

20 Transcribe better

With this setup, your transcriptions should take a lot less time and generally be a little easier to do. Hopefully, this will mean your final product, whether it's for your blog or a newspaper article, or one of the many other text outlets out there, turns out even better. Play about with some of the things we have covered in this tutorial to make a setup that perfectly suits your needs, and you'll be getting to the heart of your subject in no time.



Left Running a private cloud? Make sure no one can break into it...

Secure your Raspberry Pi

Concerned about the security of data stored on your Raspberry Pi? Protect yourself with passwords, firewalls and some physical security

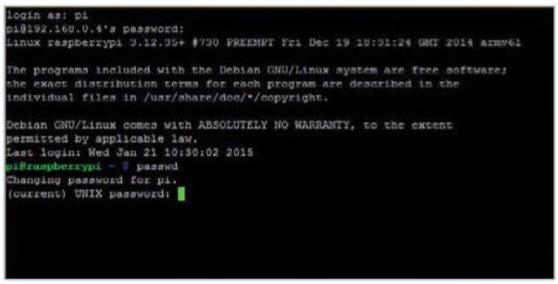
There is a distinct security risk around your Raspberry Pi. Storing anything from passwords to firewalls, this important saved data can be stolen or pocketed with minimal effort if someone knows how.

Therefore it's a relief to learn that several tools, tricks and methods can be applied to keep your device and data away from prying eyes. You might, for example, be running a home security cam with images uploaded to a cloud account. These images would be visible to anyone who possesses your Raspberry Pi's login details if you haven't bothered to change the defaults. Such a project (and many others) also demands that a firewall is installed for further improved security on a network.

Whether you're simply changing passwords, keeping your Pi under lock and key or installing a firewall, you'll be surprised at how easy it is to secure your Raspberry Pi and protect all of your important information and files.

What you'll need

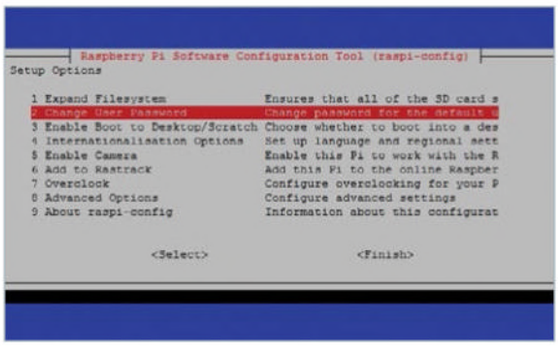
- Velcro
- Adhesive putty
- Lockable cupboard, strongbox, etc.



01 Stop using the default password

Everyone who uses a Raspberry Pi knows that the default Raspbian credentials are 'pi' and 'raspberry'. Naturally, this means that anyone can sign into your computer if you haven't changed these defaults – something you'll need to do as a matter of urgency. After signing in, open the terminal and set a new password with:

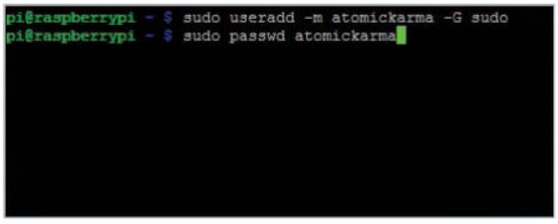
```
passwd
```



02 Change password with raspi-config

If you're setting up a new installation of Raspbian, changing the password is one of the first things that you should do. With a new install, the first boot will automatically run the raspi-config screen.

Here, use the arrow keys to find the second option, change User Password and then follow the on-screen prompts to set yourself a new passcode.



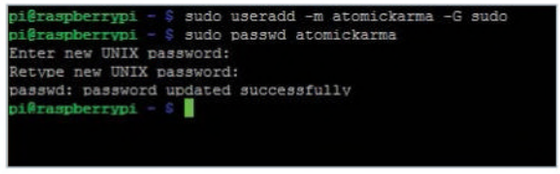
03 Create a new user account

To completely baffle anyone attempting to gain access using default credentials, take the most secure option and create a new user account. In the command line, enter:

```
sudo useradd -m username -G sudo
```

The –m switch creates a new home directory, while the second sudo adds the new account to the superuser group.

"With just a desktop computer and SD card reader, there is a way that you can recover your password"

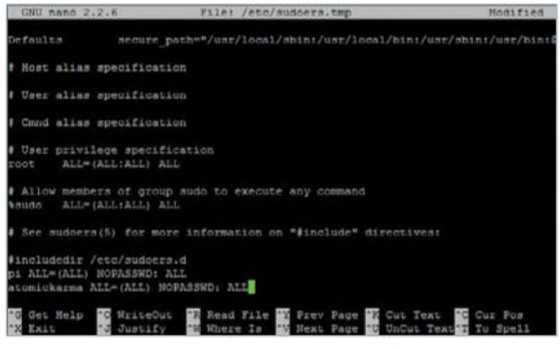


04 Give the new account a password

With the new account set up, the next step is to set a password. As you're not signed into the account at this stage, you won't be using the **passwd** command. Instead, enter:

```
sudo passwd username
```

With the new account ready to use, you should be ready to remove the default pi account from Raspbian altogether.



05 Delete the default Raspbian account

You no longer need the default user account, pi. Sign out and login to your new account, and confirm it is correctly set up by opening:

```
sudo visudo
```

...and adding...

```
username ALL=(ALL) NOPASSWD: ALL
```

...to the final line. Save and exit with Ctrl+X. Now that's done, simply delete the old account with:

```
sudo deluser pi
```

Then remove the home directory:

```
sudo deluser -remove-home pi
```

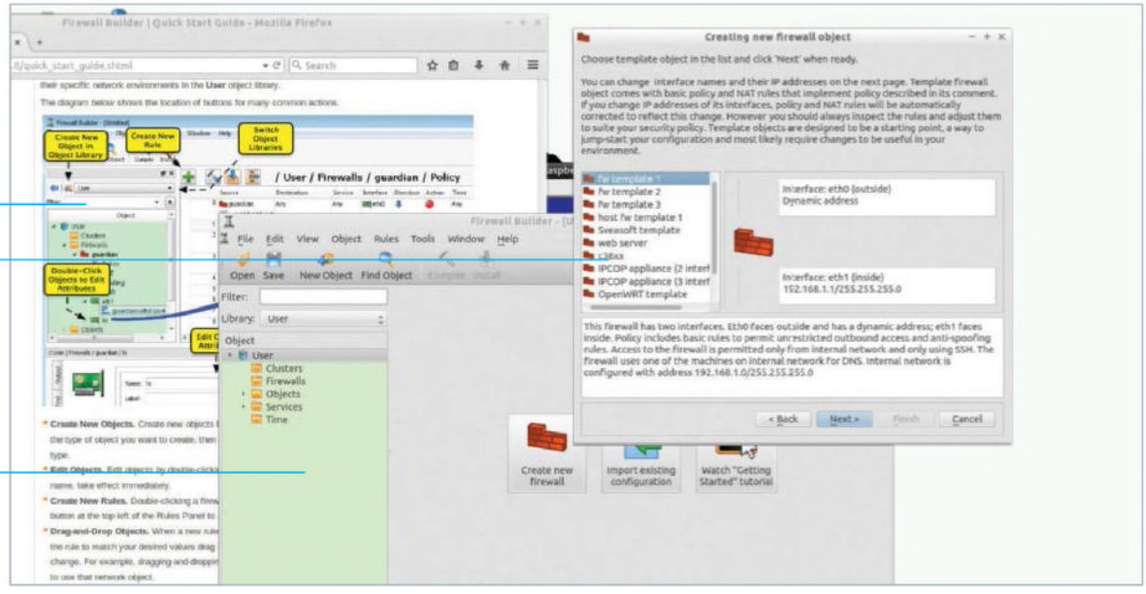
06 Recover a lost password

If you've somehow forgotten your Raspberry Pi user account password or suspect that someone has changed it, what can you do?

With a desktop computer and SD card reader, there is a way that you can recover your password. Begin by inserting the Pi's SD card into your PC's card reader.

Use a proximity sensor

If you're genuinely concerned about your Raspberry Pi's physical security, you may consider employing some additional hardware to make it less of a target. Your best option here is probably a proximity sensor configured to detect an unauthorised presence. When coupled with a buzzer, this can detect the presence of an intruder and alert you. It's even possible to configure such an alert as an email message if you're likely to be elsewhere, and it makes for a great side project.



Hiding hardware

Putting your hardware out of sight and/or out of reach is a good option for security, and for something as small as the Raspberry Pi and an SD card you have quite a few options. For instance, using Velcro or some adhesive putty you might attach the computer to the back of a cupboard or unit, kitchen kickboards or even under a car seat. The SD card, meanwhile, is so compact that you could easily place it under a carpet or even make a home for it in a cushion or shelf – just don't forget where you put it!

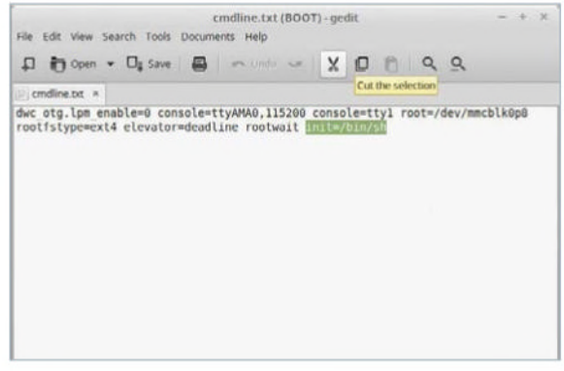


07 Edit cmdline.txt

Find the file cmdline.txt and open it in your Linux desktop text editor. Add the following to the end of the last line of the file:

```
init=/bin/sh
```

As the Raspberry Pi boots, this command will be read, enabling us to access a screen to reset the password. Save and eject the card.



08 Change the lost password

Unfortunately you won't be able to use SSH to recover the password, so instead connect a monitor and keyboard to your Raspberry Pi. Boot the Pi and wait for the prompt, at which point you should enter:

```
passwd username
```

Type the password, hit Enter and type it again to confirm.

09 Initialise the Raspbian boot

Thanks to the added code, we have changed the standard Raspbian boot to display a new prompt that will let us change the password.

When this is done, enter the following command to put things back in order:

```
sync
exec /sbin/init
```

The Pi will now boot Raspbian normally, enabling you to sign in with the new password.

10 Revert cmdline.txt

We are not done yet though. Safely shutdown your Raspberry Pi with:

```
sudo shutdown -h now
```

With the Pi powered down, remove the SD card and insert it into the card reader again. Open cmdline.txt in your text editor once again and remove init=/bin/sh, then save and exit. This stops anyone else from resetting your password.

11 Physically secure your Raspberry Pi

Keeping digital intruders out of your Raspberry Pi with firewalls and secure account passwords is only part of the story. To fully protect your Pi you need to think outside of the box.

Barely larger than a credit card, the Raspberry Pi computer can easily be picked up and palmed. Physical security is paramount, but a genuinely secure Raspberry Pi case – for example, one compatible with Kensington locks – has yet to be released. However the ProtoArmour aluminium case from **www.mobileappsystems.com** can be screwed to a secure surface, which is great for more permanent project setups.



Below If you tend to access your Pi remotely via Wi-Fi, consider keeping it locked away

12 Lock it in a drawer

Probably the best way to keep your Raspberry Pi secure is to make sure you keep it locked in a drawer or cabinet – particularly useful if you use the device as part of a security cam system or as a cloud server storing valuable documents.

If no lockable storage is available and you're taking some time away from home where it isn't practical to take the Pi with you, another solution is needed. This might be to travel with your Pi's SD card in your wallet, perhaps leaving the computer attached to the back of a wardrobe with Velcro.

13 Add a firewall

Regardless of which operating system you're using, adding a firewall is a guaranteed way to improve your computer's security. While the Raspberry Pi has a built-in firewall, it is tricky to configure.

Thankfully, some other people have noticed this too and released fwbuilder, an interface to the otherwise complex iptables firewall that comes with Raspbian.

14 Install fwbuilder in Raspbian

Because iptables is a bit fiddly and errors can leave you with no network connection, fwbuilder has been developed to make firewall configuration quick and painless.

We'll use the **apt-get** command to first check for updates and then install fwbuilder:

```
sudo apt-get update
sudo apt-get install fwbuilder
```

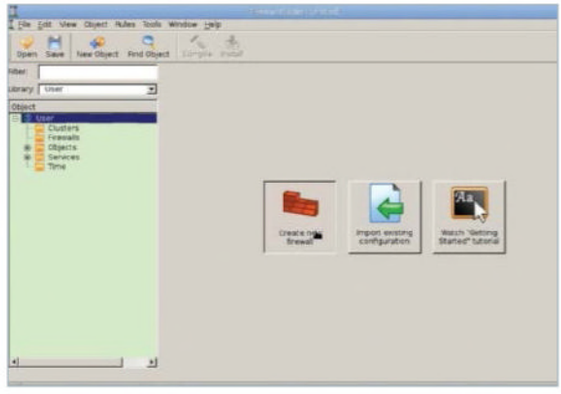
Follow the prompts to install and, once complete, switch to the Raspberry Pi GUI by entering:

```
startx
```

In the Pi's mouse-driven desktop, launch fwbuilder from the Internet menu. Upon launching fwbuilder, follow the given steps to set up your Raspeberry Pi firewall and save the resulting script.

We're nearly done but some adjustments are still required before your Pi fully connects to the network.

"A firewall is guaranteed to improve your security"



15 Complete firewall configuration

Launch the /etc/network/interfaces script in your text editor and complete configuration by adding

```
pre-up /home/pi/fwbuilder/firewall.fw
```

Next, find the section labelled "Epilog" and add

```
route add default gw [YOUR.ROUTER.IP.HERE] eth0
```

If you're using a wireless card, add the same line but switch the last characters to wlan0:

```
route add default gw [YOUR.ROUTER.IP.HERE] wlan0
```

16 Consider Raspberry Pi theft

While losing your Raspberry Pi or the data on it, might initially seem like a disaster, don't be disheartened. As long as you have taken steps to backup data or clone your SD card, you at least have continuity when you resume the project. You can also check our boxouts for methods to help you deal with physical theft.

Pocket your Pi

If you're still concerned with your Pi's safety, put yourself in the place of a potential thief. Where would you stash it? Probably in your pocket. The Raspberry Pi is small enough to take with you, so why leave it lying around? Any security questions relating to your Raspberry Pi can be addressed by keeping it close whenever necessary.

Tips | Tricks | Hacks | Apps

HACKS



```
import picam
import time
ii = picam.
takePhotoWithDetails(640,480, 85)
filename = "/tmp/picam-%s.jpg" % time.
strftime("%Y%m%d-%H%M%S")
ii.save(filename)
```

Lift the lid on Linux and get tinkering

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Get rock-solid defences for your systems

108 **Build your own Qt5-powered desktop**
Discover apps to fit an LxQt environment

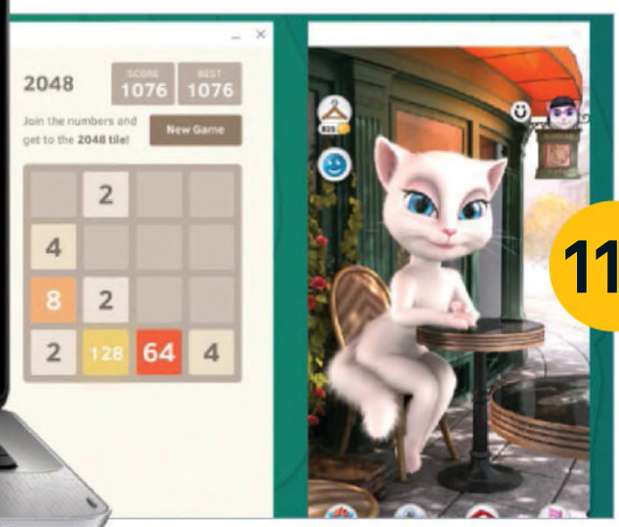
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Enjoy mobile apps on your Linux desktop

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Access your Pi wirelessly on the go

"The benefit of creating your own spin is the ability to include specific packages that are particularly relevant to your needs"









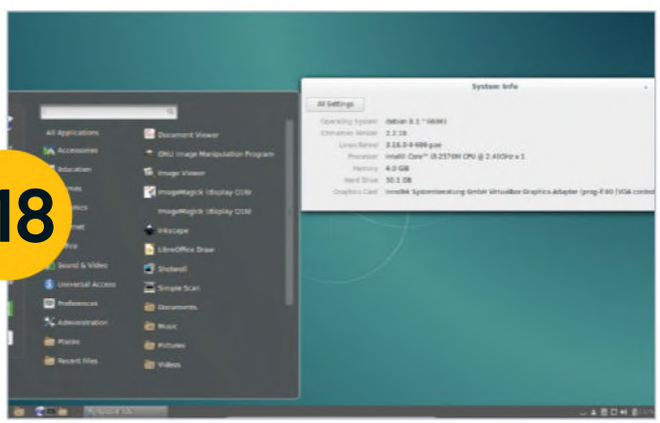
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Get rock-solid defences on your systems and networks with this guide to Linux safety

Linux has a well-deserved reputation for being incredibly secure in comparison to operating systems like Windows and OS X. However, that said, you can't simply rest on your laurels and assume that your computer is impervious to attack – especially in the wake of security scare stories over the course of the last few months such as Heartbleed, Shellshock and the Turla malware, as well as the ever-present threat of more direct system and account intrusions.

This month we're going to tackle security on a number of fronts. First up we'll go through good password practice with a fine-tooth comb, picking out everything that you need to know and showing you how to create super-safe passwords. We'll then take a look at client-side security by running through the optimal settings for your machine and suggesting ways for you to ensure everything important is protected. Networks are next – we'll explain how to build firewalls and properly set up and control your ports, then go through the principles of penetration testing. Finally, we'll return to online matters with a look at securing your various accounts, including using two-factor authentication, and then locking down any information that could potentially be used to hack your accounts. Let's get started.

PASSWORD SECURITY

Creating an invincible password is the first step to securing everything

One of the most important steps in keeping anything secure is to create a very strong password that is difficult to crack. While movies will tell you enterprising hackers just need to look around your office to figure out your password ("it's his son's name – easy"), the most common method of password cracking is a brute force attack on the server and the username.

Under a brute force attack, short passwords, unmodified dictionary words and anything on top password lists will succumb very quickly. In terms of length of password versus time to crack it, the hours and days needed to successfully discover a password are always going down thanks to advancements in CPU speed and bandwidth. Using simple alphanumeric passwords are increasingly insecure, even if they're as long as ten characters.

Let's start with a password then and modify it – a non-dictionary word, reasonably long. Plucked out of the air we have:

`dwanton`

– Seven characters, lower case letters

Time to crack: two seconds

Seven is quite short. If you're using it online, most websites require a minimum of eight letters, a capital letter and a number. This drastically improves the quality of the password, both offline and online. A basic modification would be:

`Dwanton1`

– Eight characters, alphanumeric mixture of lower and upper case



Above There are a few websites that will check your password, but make sure to use something similar

Time to crack: 15 hours

Doing a lot better! The password is immediately exponentially more secure, although 15 hours is still not that long. We can do better by adding a symbol to the mix in an easy-to-remember location:

`Dw@nton1`

– Eight characters, alphanumeric and symbol mixture

Time to crack: 3 days

Another big jump to three days. In theory, most people would give up by now, but as we're dealing with an automated brute force, that won't matter. We're at about as secure as we can be with an eight-character password in terms of brute force, and the '1' at the end is a bit basic. By just making it a two digit number we can further increase the time to crack:

`Dw@nton12`

– Nine characters, alphanumeric and symbol mixture

Time to crack: 275 days

275 days is quite a while, but it's still doable for persistent crackers. Adding a symbol, letter or number to the end of this password will increase its lifespan to 58 years. 58 years is a massively long time for someone to be trying to crack your password without upgrading their hardware and software or simply forgetting about it. So here's an example of an excellent starter password idea:

`Dw@nton12*`

We say starter, as while this is an excellent password, you shouldn't be using it on every account that you have. If a list of passwords is leaked due to someone else's insecurity, it doesn't matter how long your password will take to brute-force if they already know what it is. If you hear of a leak, change your password immediately.

PASSWORD DO'S & DON'TS

DO

- Use capitals, numbers and basic symbols
- Reset online ones every six months
- Make sure it's at least nine characters long
- Run something similar to your password through a password checker

DON'T

- Use dictionary words
- Use phrases
- Use personal information
- Use consecutive numbers
- Use numbers such as your two-digit birth year
- Use the same password everywhere
- Write them down
- Make them too long

"Using simple alphanumeric passwords is becoming increasingly insecure"

ONLINE SECURITY

Effectively use your passwords online and employ other security measures

Now we have a basic password, it's time to start implementing it online. Security experts say you should use a different password for every account. Services like LastPass can offer a convenient way of doing this with truly unique passwords per account, but you might not be comfortable with them. Human beings can only remember so many passwords; as you most definitely should not be making a note of these passwords, what we suggest is to modify the password based on what website you're using it on.

For example, let's take Amazon. It has your credit card details so securing the account is extremely important. After the 'Dw@n' of the 'dwanton' base we have three characters to play with, so we could change them for our Amazon password. Here's our working:

Take the middle three letters of the site's name (as Amazon is six letters long we will choose 'maz'), and reverse the letters to 'zam'. Now insert it into our password:

```
Dw@nzam12*
```

This still has the high level of security, but will be different from, say, eBay (Dw@nabe12*) or Github (Dw@nhti12*), without being immediately obvious to whatever cracking program would then try and use that password on other websites and accounts. A smart enough human might crack the code, but this is only an example of how you can modify your password while still making it memorable to yourself.

Security and Privacy

Last issue we touched upon how to keep your details as private as possible. As well as brute force attacks, crackers can perform confidence and social manipulation tricks with phone support to deceive you, using any information they can gather from social accounts. Some of the privacy-orientated recommendations can help keep angles of attack secret from malicious people.

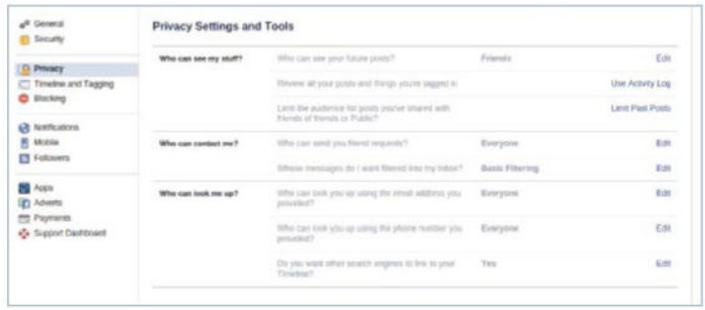
Go through your social media accounts – Twitter and Facebook mainly – and look at your privacy settings. Make sure nothing sensitive is set to private, and even think of removing items that you don't need on your profile, such as phone numbers on Facebook or location on Twitter. Most importantly, keep your main email address completely secret: never share it on Twitter unless via a DM to someone you trust and don't keep it in your profile. For work email, use a different address and link as few accounts as possible to this email.

Lastly, while an extreme step, you can always look at not using your real name on your more public social media accounts. Facebook won't truly allow it for personal accounts, but everywhere else you can it's a good idea to use a pseudonym if you want to be as secure and private as possible.



Above LastPass won our password managers group test a couple of issues back

Below Controlling your visibility on platforms like Facebook is crucial to security



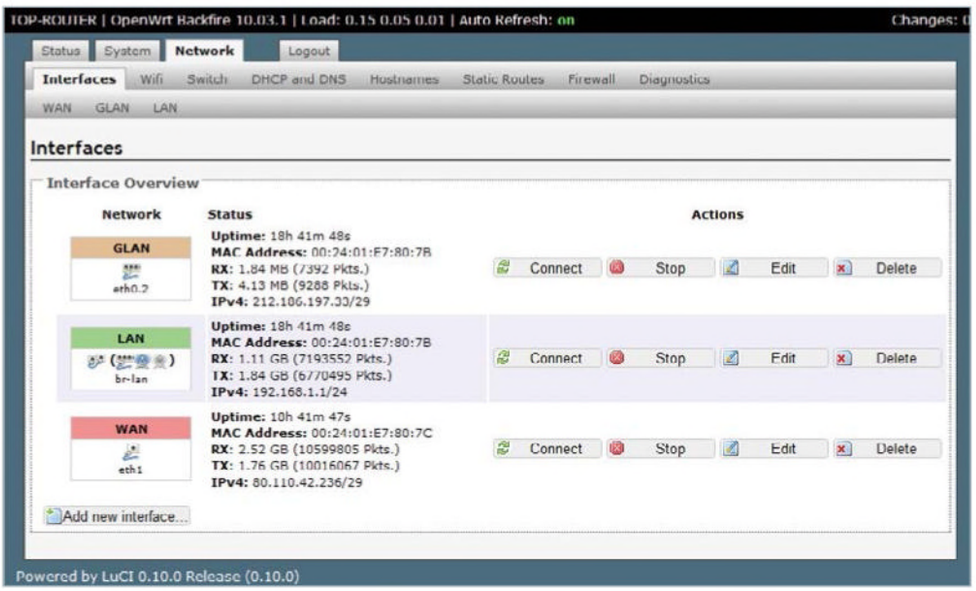
TWO-FACTOR AUTHENTICATION

One of the best security features of recent years is two-factor authentication. Google, Apple, Tumblr and many other services and websites with sensitive information now include two-factor authentication to increase security.

Usually, a mobile number is securely supplied to the company, which then sends you a message including a special, one-use code to work in-conjunction with any system you're trying to log into the account with. Other companies will send it via email or allow you to use a special app similar to banking keypads. Turning this on may be slightly inconvenient to some, but the peace of mind and added security is well worth it.

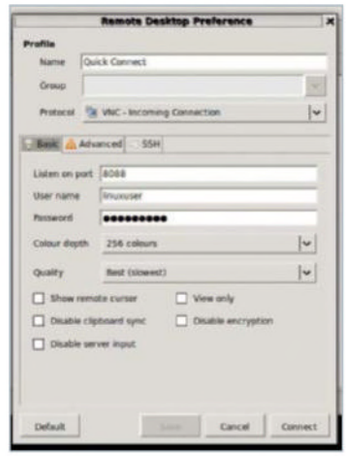
NETWORK SECURITY

Protect your local network from the occurrence of external or local intrusions



Below Some tools may be superfluous depending on how you use your system

Left Changing settings in the router can really improve your network's security



Now you've secured your online life, it's a good idea to look at your actual physical network of home or office PCs, laptops and other devices. Having a strong password on your Gmail account is one thing, but if someone can see exactly the kind of packets are going back and forth they can likely figure out what you're looking at. Securing your network is an important step, but it's also fraught with problems you may never know exist, especially when you're trying to balance convenience with security on a system provided by an ISP.

Shared folders, Samba servers and SSH access are very common within networks, allowing you access files and folders remotely. They're also excellent attack vectors by those who can get into your network. Uninstalling or deactivating networking services you don't use is a great way to increase security throughout your network. This is another convenience versus security debate – some networked devices (such as a Raspberry Pi or file server) you may wish to SSH into. That's fine, just make sure that to access them, you require a strong password. Same with the Samba shares for distributing music over your home network and the like. VNC you can probably turn off and on via SSH so you only access it when you definitely need to. There's a lot of just thinking about how you interact with other devices over the network in terms of network security that can help out.

Network monitoring

What if there's activity over your network that you don't know of and therefore can't immediately fix? One of the best tools in any sysadmin or network security toolbox is Wireshark, or more specifically, the tshark command line implementation.

Wireshark is a network package sniffer and allows you to track all the network traffic going on around your LAN. This can be used to figure out whats going on in your network that you don't know about, stray services and requests and data transfers that either you didn't know about and simply turn off, to finding out some program is transmitting data that it most likely shouldn't be.

FIREWALLS

Your router will come with a firewall built in and it will be pretty good. If you have a custom server on your network, either at home or around the office, then you can probably make a better one – one that you have far more control over and that will do a better job of protecting your network overall.

You can do this simply by using 'iptables', a command line tool available for any version of Linux that lets you set up custom rules for IP addresses that can access the server, custom port forwarding and other great changes that make it a lot more useful to certain people.

The Arch and Ubuntu wikis have some great guides: **bit.ly/1yCwG4N** (Arch) and **bit.ly/1gd18ul** (Ubuntu).

Router maintenance

Your router, as the creator and guardian of your network, isn't impervious to attacks either. As well as updating any default passwords that may exist for the admin user, you should always make sure to update your router's firmware as regularly as possible. Updates will include security fixes for any vulnerabilities that are present and should improve security across the router's software overall.

If your router allows it, you can also attempt to change the default IP addresses and range. If you're using DHCP, this won't matter to any connected devices, but changing the default network addresses from the common 192.168.x.x structure will stop other types of attacks on the network that specifically target the router.

OFFLINE SECURITY

Keep your desktop and other offline devices secure from prying fingers

Online security and protection from online attacks are excellent deterrents for a large subsection of people, but your point of access – your PC – should be secure as well unless you want to have people snooping around your computer.

As before, a secure password is essential for your user account. It's a bit harder to brute-force this kind of password, but it's still doable. Weigh up the importance of your files versus your own convenience to come up with a password that suits your needs, but still use the password creation tips to keep it as secure as possible.

The root password shouldn't be the same as a normal user password. Much like we suggested with emails, you should most certainly have a completely separate password for the root account. While logged in as root (su in the terminal) type 'passwd' and it will allow you to update and change your current root password.

Some systems will also allow users to gain root access via 'sudo su', using sudoer privileges to just get into the root. If you're serious about locking down your system then a big priority should be to modify sudoer access on all accounts on your system that can make use of it, especially for that particular use case.

Malware

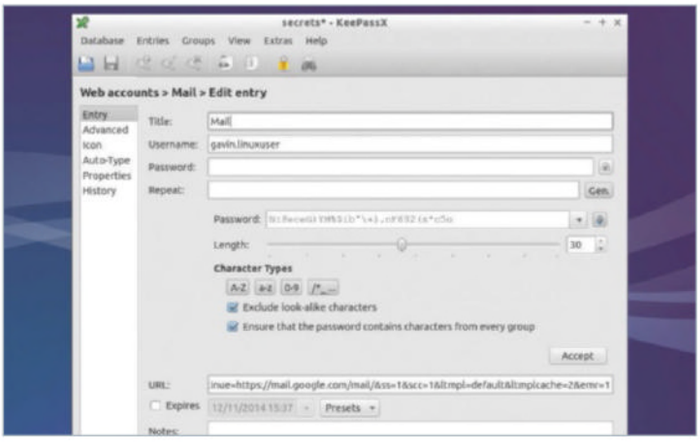
Linux distros are generally far more secure than other operating systems, but they're not immune to viruses and malware. In terms of security, keyloggers and other snooping software can be a big issue – these will help anyone figure out your passwords, making even the most random 12-character monstrosities pointless when it can just be copied and pasted directly into the password field.

Asides from ClamAV, there's no real anti-malware software for Linux available; the best thing you can do is just stay vigilant. Use a little common sense when on the Internet and check your logs and running services frequently to make sure nothing malicious has installed itself.

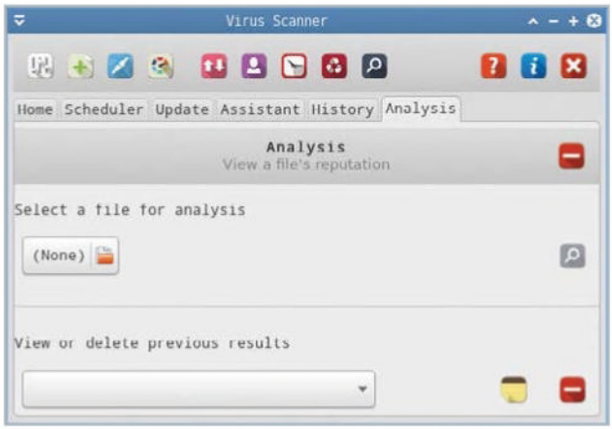
Protect your files

Even with a good password, someone can just mount your hard drive or a user with higher privileges can easily read it. Encrypting a volume to specifically keep sensitive data in is a great way to make sure only you can access the files when you need to. Since TrueCrypt has become defunct, and was never really open source in the first place, we highly recommend using EncFS.

It's available in a few repos as encfs, so installing it is not really a problem.



"The root password shouldn't be the same as a user password"



Above ClamAV is the best you'll find in terms of anti-malware FOSS

KEEPASS X

While LastPass is a password manager for your online accounts, KeePass X is a password manager for the apps and software on your system. Not only does it keep your systemwide passwords more secure, it also allows you to encrypt information such as URLs, user names, attachments and clipboard items if needed. It has a smart database that you can search as long as you have the right password, otherwise it's completely encrypted. It's currently in Alpha release stage for version 2.0, but a lot of Linux users are already integrating it into their system and workflow due to its quality.

Once that's done, you can then begin setting up an encrypted location on your system. Open the terminal and then type:

```
$ encfs ~/encrypted ~/Private
```

This will create a folder called 'encrypted' in your home directory that contains all the encrypted files, and then another folder called 'private' which is where the files will be accessible once decrypted. Follow through with the little wizard that follows – the preconfigured security mode is very good and good enough for most people.

Now, when Private is mounted and you have entered a password, you'll be able to access the encrypted files straight from the encrypted folder. When it's unmounted, the files will become encrypted once again; just remember to unmount after use.

SECURITY RESOURCES

Keep up to date on security concerns and learn more ways to keep your accounts safe

Privacy Fix privacyfix.com

As we mentioned earlier in the article, defending against a brute force attack is only one method in keeping everything secure. Hackers and crackers may also try social manipulation via telephone or email to get your information from banks and account support teams. You can minimise this risk significantly by keep more of your information private.

Privacy Fix from AVG helps you monitor your different social accounts to figure out exactly what people can see and how easily they can see it. It allows you to plug holes in your accounts and tighten up your privacy and security in general.

The applications work across multiple platforms, so you can keep control of these concerns on the go via mobile if something needs to be changed immediately. It covers Twitter, Facebook, Google+, LinkedIn and many other account types.



Above PrivacyFix rounds up your online accounts into a single dashboard

Linux Security linuxsecurity.com



Linux Security is a news aggregate for anything related to security in Linux. Not only does it cover vulnerabilities, bugs in security software and other desktop and server security concerns, it also covers web security and think pieces that will keep you informed on the latest security stories.

Keeping up with relevant issues in the security world can keep you ahead of the game and enable you to lock down anything before a threat becomes viable. It's not absolutely necessary for everyone, but even those slightly interested in keeping secure would do well to keep up with some of the current trends.

There are also some other resources on the site, such as a security glossary for some of the more obscure terms and general security tips that anyone can use.



Above Linux Security is a news aggregate for anything related to Linux

Random.org random.org/passwords



Coming up with a password or password base can be difficult. While we have the example in this issue, we implore you not to use it. However, if you're having trouble coming up with your own base, or want a completely random and secure password for your email accounts, there are lots of websites that will enable you to securely and anonymously generate passwords that you could then slightly modify and use yourself.

Random.org is such a website, where you can create a list of passwords of varying character length that are all very secure. Nothing is stored on their servers and all passwords are sent securely via SSL. The random algorithm uses ambient noise to create the password, which makes it slightly more difficult to decrypt using high-level cryptographic techniques.



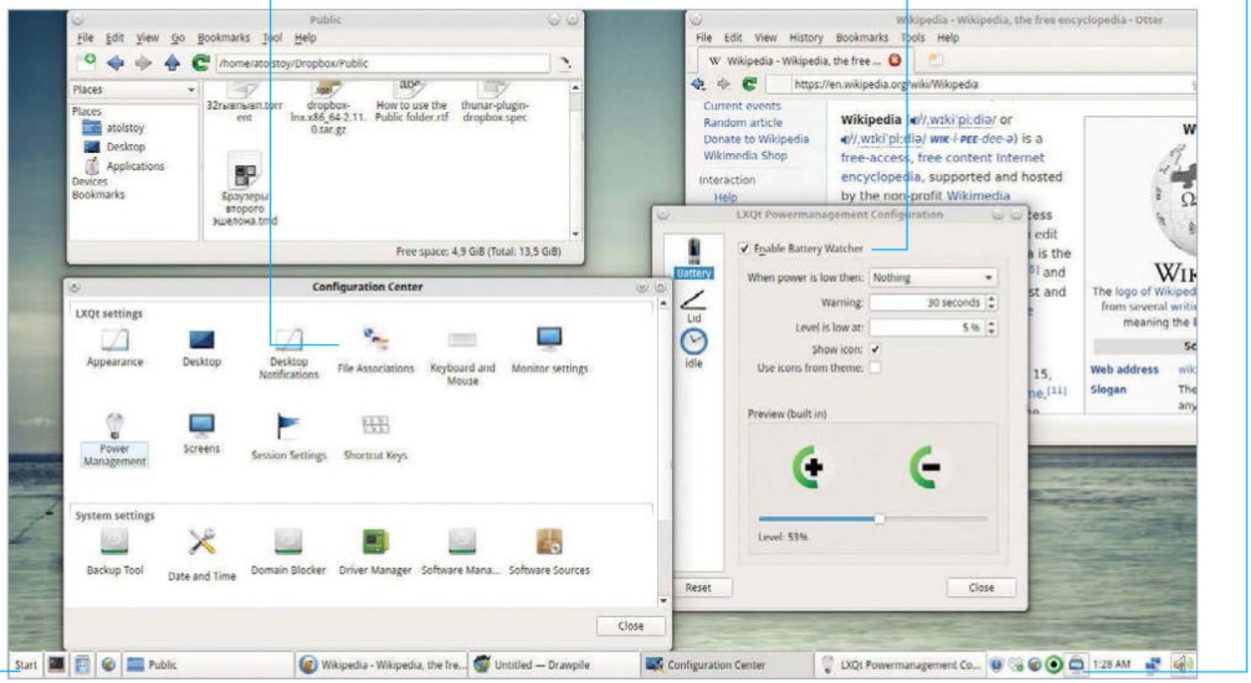
Above Random.org comes up with highly secure passwords

Drag application launchers from the menu to the start menu and launcher pane

The LxQt configuration centre even hosts third-party and system-wide modules

LxQt already has a power management tool where you can specify different actions

The system tray supports the embedding of Skype, Dropbox and more, without sni-qt



Build your own Qt5-powered desktop

Discover Qt5-based desktop applications that could fit an LxQt environment

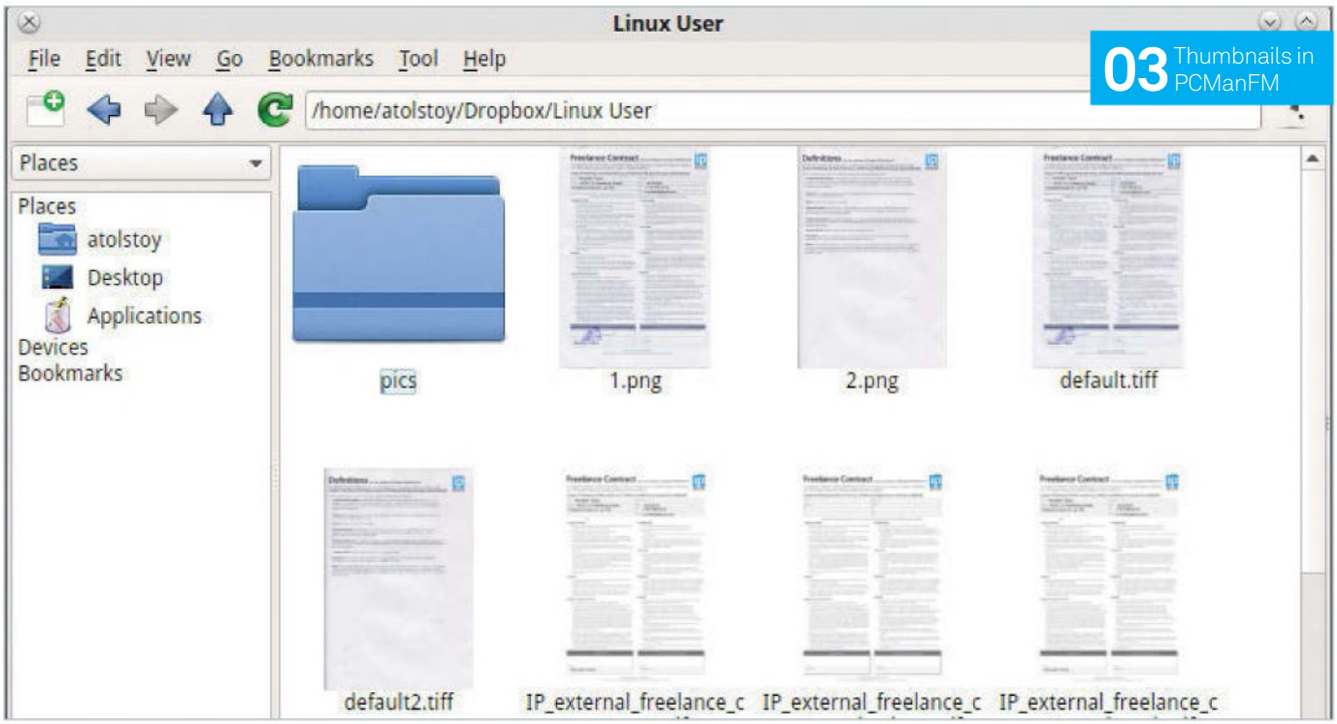
LxQt is a great lightweight desktop environment, but it's still in the early stages of development and lacks many vital features. However, it is a very promising and modern software built around the Qt5 graphic library. For many, the best way to try out a Qt5-powered desktop is the new Plasma 5 from the KDE project, but we will go a different way. We'll be purists and try to use only Qt5 applications in everyday life together with LxQt, and entirely away from KDE. What's the point? This will reveal the general readiness of the Qt5 applications stack and its feature coverage.

With acceptable compromise in mind, we will try to show you modern yet compact programs for common desktop activities. The whole idea is also a test ground for building a lightweight Linux solution which could be useful on low-end machines. The LxQt desktop was chosen just for test purposes thanks to its great availability on Linux (BSD users would most probably prefer Lumina).

So we are going to look at certain distros to find out which LxQt delivery is particularly good, and then we will install and become acquainted with the Otter browser, PhotoQT image viewer, Trojitá mail client, Albert launcher, DrawPile collaboration tool, SMPlayer, FocusWriter and more. So if you're ready, head to step one.

Resources

Otter Browser otter-browser.org
PhotoQt Image Viewer photoqt.org
Albert Launcher bit.ly/1LGqmOj
Trojitá Mail client trojita.flaska.net
Drawpile drawpile.net
SMPlayer SMPlayer.sourceforge.net
FocusWriter gottcode.org/FocusWriter
Cool Retro Term bit.ly/1BSYWTz



03 Thumbnails in PCManFM

01 Choose a distribution

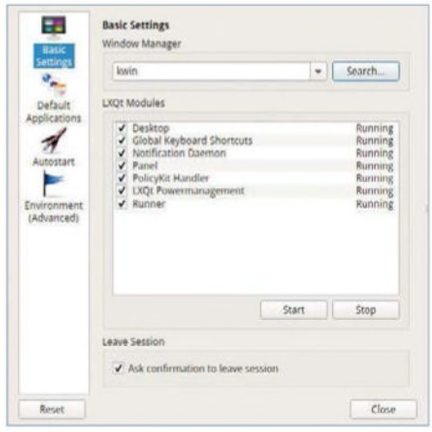
There is an abundance of easy-to-use Linux distros that could help you instantly get started with a usable LxQt desktop – it is up to you to take your pick.

Lubuntu is a dedicated LxQt flavour of Ubuntu with a 'daily' PPA containing the most recent code (ppa:lubuntu-dev/lubuntu-daily). The PPA is compatible with most Ubuntu 14.04 and 14.10 derivatives, including Kubuntu, LXLE, Mint and many of the others. To get LxQt you will need to possess lxqt-metapackage, lxqt-session and lxsession packages.

An alternative way to install LxQt could be Arch/Manjaro (LxQt is in AUR) or the development version of OpenMandriva, which is shipped with LxQt by default (Plasma 5 will arrive at a later date).

02 What we have so far

The desktop occupies ~95 MBs of RAM. It features a control centre, power management applet, customisable bottom panel, look and feel settings manager, window manager chooser, QTerminal console and PCManFM file manager. Keyboard layouts indicator and NetworkManager applet are currently missing, but you can take the XFCE applet and gorgeous CMST (frontend to ConnMan) respectively.



By default, the windows decorations are managed by OpenBox but you can change it to Kwin or Emerald. PCManFM is quite modest, but keep in mind that it is the only Qt5 file manager for the day.

03 Thumbnails in PCManFM

We can tweak and add extra functionality to the PCManFM file manager. First, let's add thumbnails support for filetypes other than images. For example, for PDF create a new file with the .thumbnail extension at /usr/share/thumbnailers with the following content:

```
[Thumbnailer Entry]
  TryExec=convert
  Exec=convert %i[0] -thumbnail %s %o
  MimeType=application/pdf;application/x-pdf;image/pdf;
```

Using this template you can add more types that 'convert' supports (it's a part of ImageMagick).

04 Get Otter Browser

The Otter web browser is updated every week so if you're interested in its progress, you can track its development on the project website. For Ubuntu-compatible Linux systems there's a very handy PPA. So wuthout further ado, let's get into it straight away:

```
sudo add-apt-repository ppa:otter-browser/daily
sudo apt-get update
sudo apt-get install otter-browser-git
```

The Otter Browser has a variety of lovely features, such as tabs grouping, mouse gestures and a highly customisable UI.

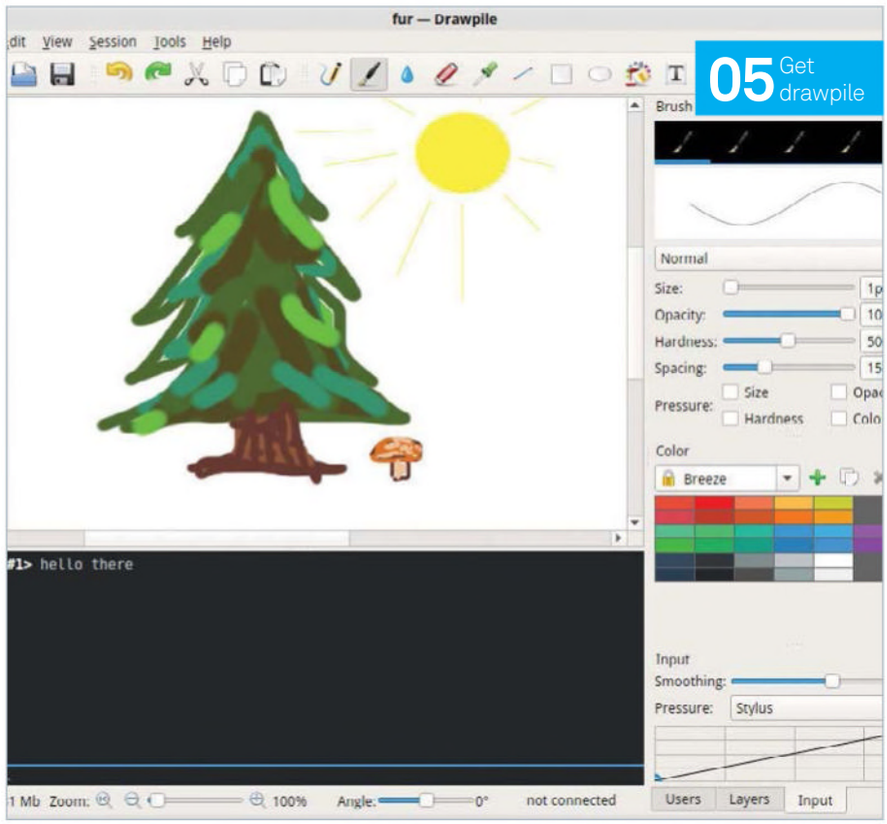
You can choose to set the browser as a default web application if you want by selecting otter-browser from the Web Browser menu in the System Settings.

Living lightweight

Qt5 has been around for years and more Qt applications are moving to use it. Right now we can build a decent, highly usable desktop around LxQt. Network connections can be managed with ConnMan and its CMST frontend, Dropbox client is already using Qt5 and LxQt System Settings work just as well as the same-named KDE module. There is also a web browser, email client and a versatile media player available to access.

How does it compare to the KDE desktop? There's no easy answer. Firstly, the hand-made LxQt desktop has less features than either KDE4 or the new Plasma 5 desktop, but it's a lot lighter. Pure LxQt needs less than 100 megabytes of RAM and each extra Qt5 application adds very few. Secondly, current Plasma 5 choices (like Kubuntu or Netrunner) are forced to mix Qt4 and Qt5 parts so that the resulting desktop is nonuniform and consumes more resources.

Lastly, you have to remember that Plasma 5 isn't quite mature yet. Though its current state is definitely a lot nicer than early KDE 4 releases in 2008-2009, some core applications still remain in the Qt4 world, unfortunately, so there will be a transitional period from KDE4 to the Plasma 5 desktop. However, if you stick with it, your patience will be rewarded!



"Trojitá has a traditional layout and features mail sorting"

05 Get Drawpile

The latest Drawpile version (0.9.8) can be installed via the Getdeb service here: **www.getdeb.net/app/DrawPile**.

The program has several applications. Firstly, it is an easy-to-understand drawing software comparable with MS Paint, Kolourpaint and Pinta – simple, beautiful, good for kids. Secondly, its UI is optimised for use in Web projects (with brushes, colour palettes, alpha handling). Finally, that black rectangle hosts a chat window. Drawpile enables several people to draw simultaneously on one canvas.

06 Use PhotoQt to view images

PhotoQT is offered via the PPA and something like the following is entered:

```
sudo add-apt-repository ppa:samrog131/ppa
sudo apt-get update
sudo apt-get install photoqt
```

Then the progam can be selected in the 'Open with...' menu in PCManFM. PhotoQT opens images in fullscreen mode by default, with image file name and its number in the top-left corner. Additional actions are available via the right-click menu on any part of the image. You can surf through your images using the respective keyboard arrows.

07 Launch apps and search with Albert

Again, there's a PPA for easy installation:

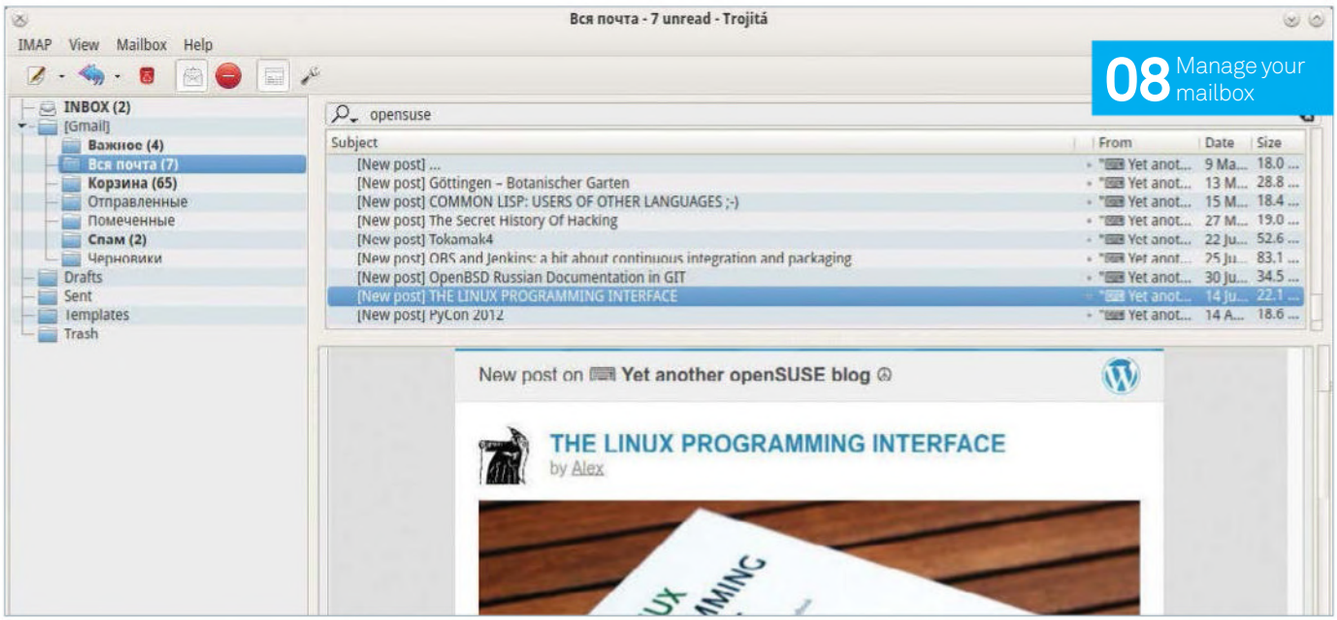
```
sudo add-apt-repository
ppa:nilarimogard/webupd8
sudo apt-get update
sudo apt-get install albert
```

The first time you launch Albert you'll see its configuration window where you can change certain settings and, what's more important, assign a shortcut for invoking Albert. After you close the window, Albert doesn't quit but simply hides in the background. Press your shortcut and you'll see the search bar. Depending on your input, Albert will offer either applications, Chromium bookmarks, or search engines that you can apply your string to.

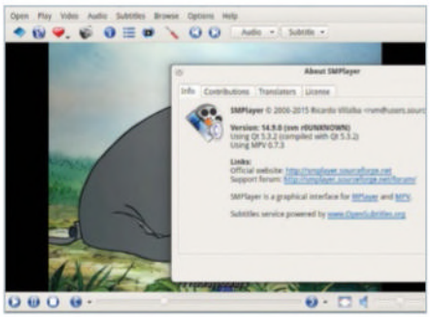
08 Manage your mailbox

Trojitá binaries are kindly offered by the OBS system (**bit.ly/1L9KV3L**), but there is only a Qt4 build. While Qt5 build does exist for other Linix distros, in the case of Ubuntu we will need to compile a Qt5 Trojitá from the source. Thankfully, the official site offers a very straightforward set of build instructions (**http://trojita.flaska.net/download.html**).

Launch the program and provide it with details of your IMAP mailbox. Public services, such as Gmail work just fine. Trojitá has a traditional layout and features mail sorting, HTML support and efficient network usage.



08 Manage your mailbox



09 Enjoy music and videos with SMPlayer

SMPlayer is a top-notch media beast, which can play almost any media, both local and remote, and even some Blu-ray discs. There's a PPA for Ubuntu family (ppa:rvm/SMPlayer), but it offers SMPlayer with Qt4, while we need a Qt5 version. So issue the following:

```
sudo apt-get build-dep smplayer
```

Then download the source tarball (**bit.ly/1Bl8gPT**) and use instructions from the Install.txt file there. The Qt5 switch is applied to the make command this way:

```
make QMAKE=/usr/lib/x86_64-linux-gnu/qt5/bin/qmake
```

Of course, you should have qt5-qmake and other Qt5 dev packages installed beforehand.

10 Write text with FocusWriter

FocusWriter is a simple typewriter-like editor which hides away almost all controls in order not to distract you from writing. Yet there are many useful features such as auto-saving, live statistics, spell checking, multi-document support and many more. You can install it using the official PPA:

```
sudo add-apt-repository ppa:gottcode/gcppa
sudo apt-get update
sudo apt-get install focuswriter
```

11 Add fun with Cool Retro Term

LxQt already has a great QTerminal application with tabs support, colour profiles and more, but we can go even further and install Qt5 and OpenGL-powered old school terminal called Cool Retro Term. The following application mimics the historic cathode tubes of Amiga, IBM and Apple workstations:

```
sudo add-apt-repository ppa:bugs-launchpad-net-falkensweb/cool-retro-term
sudo apt-get update
sudo apt-get install cool-retro-term
```

Once it is launched you can switch between profiles or change the effects manually. It is even possible to scale up the whole screen so that Cool Retro Term will be as usable as a regular console application, which is handy.

Add more apps

If you stay with your custom LxQt desktop, sooner or later you will inevitably want more. The applications featured in this tutorial are not all the Qt5 applications out there, you can supercharge your system with the following:

Voltair A fun little 2D platformer game built on top of Qt Quick and Liquidfun libraries. Getting the game compiled in Linux needs skill, but there's a perfect guide: **bit.ly/1HlMB9P**.

Friends This app features a neat QML interface and is easy to install (`sudo apt-get install friends-app`). To use it you must refer to Unity's Online Accounts section, so you need that DE or at least its goa-daemon (stored in ~/.config/goa-1.0/)

Rosa ImageWriter This is a Qt5 port of famous SUSE Studio Imagewriter. The app is improved for comfortable USB media writing. See **bit.ly/ZgurWL** for applications that are dependent on KDE Software delivery and are difficult to use outside of certain DEs.

Qt-apps.org The **qt-apps.org** website is a vital bookmark if you want to keep track of Qt5 applications. Most new and updated titles appear there.

Run Android apps in Linux

Work, play and enjoy the plentiful range of Android apps right inside your regular Linux desktop

Though Google's Android OS shares nearly the same kernel as the desktop Linux, these systems still have major differences. Linux applications can't be run on Android without porting, and vice versa. But thanks to the commercial success of smartphones and tablets running Android, plenty of useful, cool and eye-catching software titles are available in the official Google Play store – many of them are free, too. Wouldn't it be great to run these apps on a desktop computer that is running regular Linux distribution?

Well, not long ago a solution arrived: the Archon runtime – a technology that enables the running of Android apps after converting them to browser extensions. It means that you can run an unlimited number of Android APKs, after packaging them with the chromeos-apk tool that is supported along the Archon runtime itself.

Archon was initially developed as a solution to bring select Android apps to Chrome OS, but later it was discovered that running just the Chrome browser would be enough. Of course, to make it happen on your machine some manual effort, technical acumen and familiarity with command line commands are required. However, if you follow these steps then the whole procedure will be straightforward.

Resources

Google Chrome
bit.ly/1tMrggU

Archon Runtime
bit.ly/1DPh5Tr

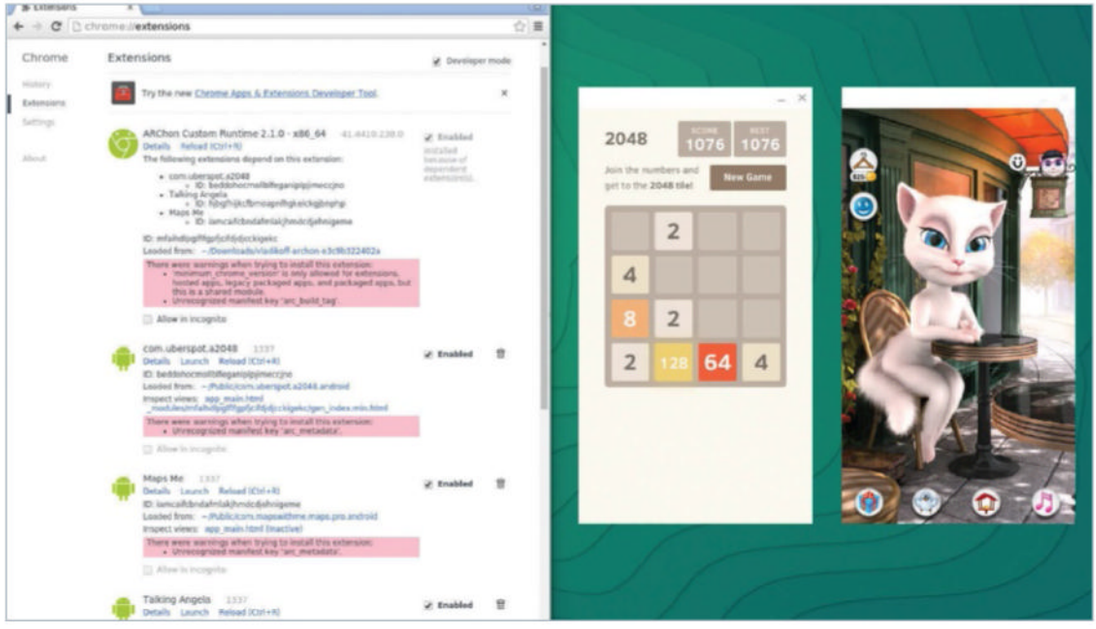
NodeJS server with NPM manager

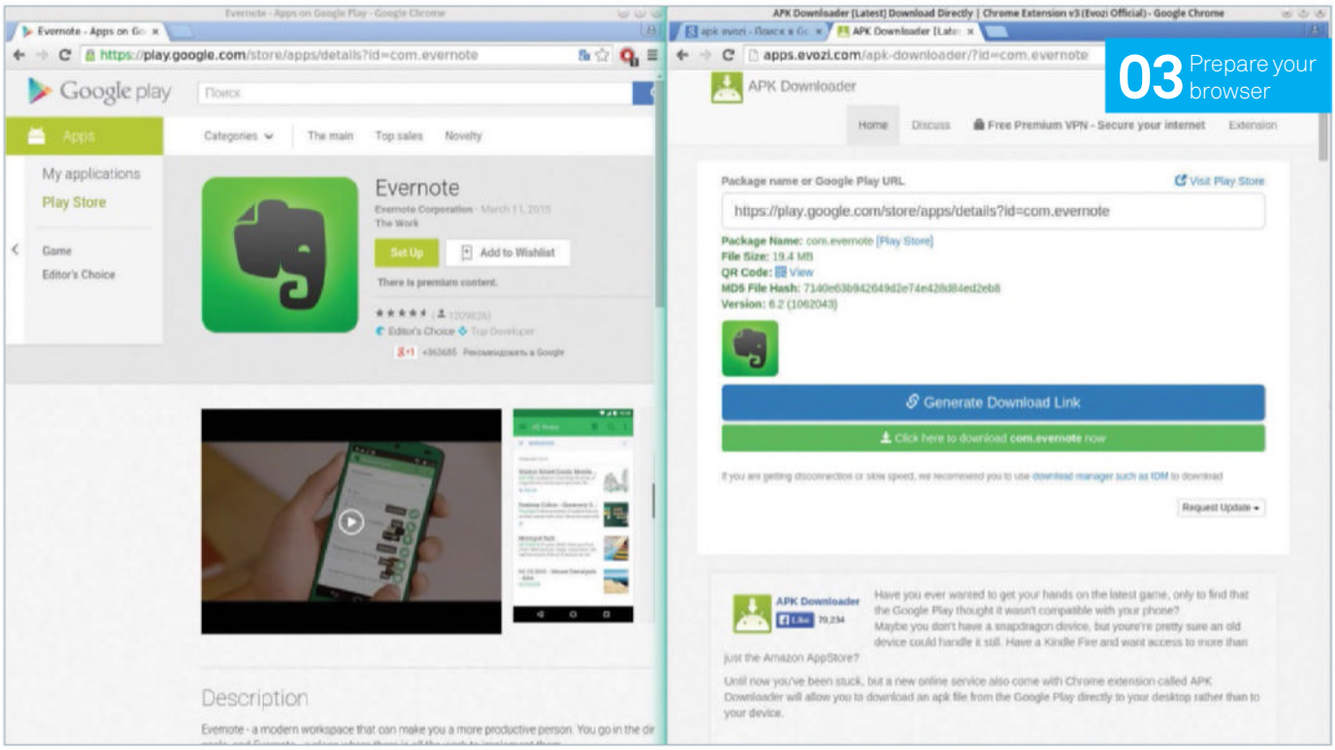
01 Install a proper web browser

In theory, not only should the Google-branded Chrome browser work fine, but Chromium (Chrome's open source base) and many derivatives such as Opera or Vivaldi should do too. But things are a little bit complicated. The Chromium development pace is fast, so these browsers can be based on different Chromium versions with different patch sets, compile options and so on. In real life, it will result in multiple failed attempts to start Archon, so that's why we recommend using a totally stable version of regular Google Chrome on Linux.

Go to the browser's official site (**google.com/chrome/browser/desktop**) and download the DEB or RPM for your distribution and architecture. You can choose what really matches your specs, as Archon offers various builds to suit everybody's needs. Then install Chrome with your standard package management tools – usually, just a double-click does the trick.

Below Archon turns Android apps into extensions for the Google Chrome browser





02 Get Archon runtime

Since 2014, several versions of Archon runtime have been released, from 1.0 to 2.1. Vlad Filippov, the main developer, has been in a constant race for the latest and greatest Chrome code, whilst fixing Archon bugs at the same time. As a result, different combinations of Chrome and Archon versions may or may not work for you. The default choice, however, is to try the latest Archon runtime build from the project's brand new site (**archon-runtime.github.io**), with the current stable Chrome version from Google. At the time of writing, the latter software is up to version 41.0.x.

03 Prepare your browser

Archon is distributed in a form of unpacked Chrome extension. When you download it, you a get a ZIP file with an extension folder inside. To be able to install unpacked extensions, go to **chrome://extensions** and tick the Developer mode checkbox. You will immediately see the new buttons, one of them will be the 'Load unpacked extension...' option. Click it and navigate to the folder where you unzipped the downloaded Archon package earlier. Once you click OK, it will appear in the installed extensions list. Before you proceed to the next step it is useful to check for WebGL support in Chrome, which can make use of hardware acceleration for graphics and help browser perform better. Go to **chrome://gpu** and see if there are any 'software only' strings. If so, switch to **chrome://flags** and enable the 'Override software rendering list' parameter.

Troubleshooting

Archon not working as it's supposed to? Here's how to find out what the trouble is and fix it

From a user's perspective, Archon isn't stable, so you may encounter errors and lockups. If things went wrong from the start, ensure that you're using the Archon of the right architecture. After that, ensure Google Native Client is enabled in your browser (**chrome://flags/#enable-nacl flag**)

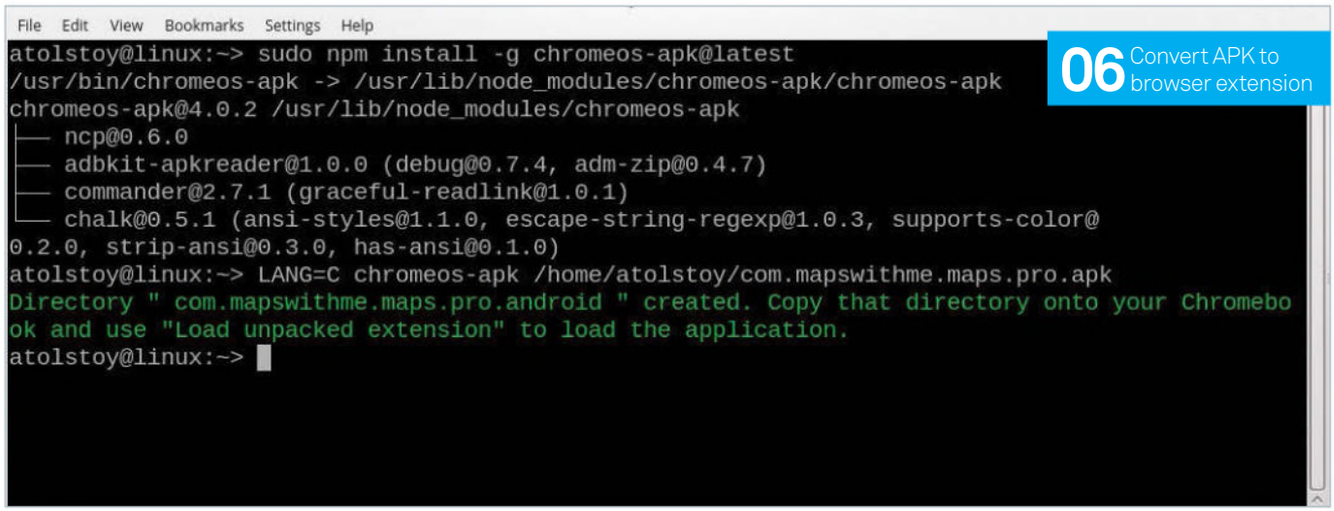
Some apps may not launch and complain of a missing 'message' element for extName. To fix it, edit the file _locales/en/messages.json inside the extension folder and add the missing item there. It should now look like this:

```
{
  "appNotSupported": {...},
  "extName": {
    "description": "Extension name",
    "message": "Whatever you like"
  }
}
```

Another frequent warning message is about the 'key' parameter. Resolve this by removing that parameter inside the extension directory.

More fixes are available on the Issues page of the Archon project: **bit.ly/1F6ezDx**. If nothing helps, change your Google Chrome version – find the Linux binaries at **bit.ly/1CewlCu**.

Above Once you obtain the Google Play link of your application, you can easily retrieve its APK file



Above Chromeos-apk shows which NodeJS modules it used to convert (or unpack) the APK as a Chrome extension, and even displays a brief manual

04 Choose and test an app

The Archon Chrome extensions itself doesn't have any means to check if it is working correctly or not. Instead, you should install at least one Android application and test it. Of course, you can't use APK files directly – you need them to be converted to Chrome extensions. At this stage, we only need to make sure that the runtime works, so we can download the sample 2048 game by Ubersoft (**bit.ly/1APJkdn**), which is already converted to extension. Unpack the ZIP file and install the resulting folder as another unpacked extension in **chrome://extensions**. You'll notice the little Launch link, which is the power button for this and every other Android application inside Chrome that you might want to install in future. There's a vast list of pre-packed extensions which you can find online (**bit.ly/1pwSU0h**). Not every app works but dozens do just fine, so you're encouraged to try your luck.

05 Obtain APK files

You might want to test and possibly use a custom Android application that you were invited to try on the Web, or already use on your Android device. In the old days there was an abundance of sources from which you could download APK files manually, but for the sake of order and security, nearly all Android titles are now concentrated in Google's Play Store. To retrieve an APK of your Play Store favourite app, use the following method:

Open the app page on the Google Play website. Then copy the link from the address bar of your browser to the clipboard; the link should look like this: **play.google.com/store/apps/details?id=com.rovio.angrybirds**.

Pass the link to any APK download service. One of the simplest ones to use is APK Downloader (**apps.evozi.com/apk-downloader**) – this will instantly generate a download link for the appropriate APK file, which you can then save onto your hard drive.

06 Convert APK to browser extension

For this you'll need the chromeos-apk tool, which is supported along with Archon by the same project. The tool is a NodeJS plugin, so the first thing we need to do is install NodeJS and its npm plugin manager. The package set and naming differs across Linux distributions – for Ubuntu and its derivatives, `sudo apt-get install nodejs`, should work. With npm we can now install chromeos-apk:

```
sudo npm install -g chromeos-apk@latest
```

After a short while the new module should be successfully installed. So to convert an APK, you can now just use the following simple syntax:

```
chromeos-apk /path/to/application.apk
```

The tool will create a folder, which can be installed in Chrome as an unpacked extension. Use the Launch link to launch it, cross your fingers and wait for a little while.

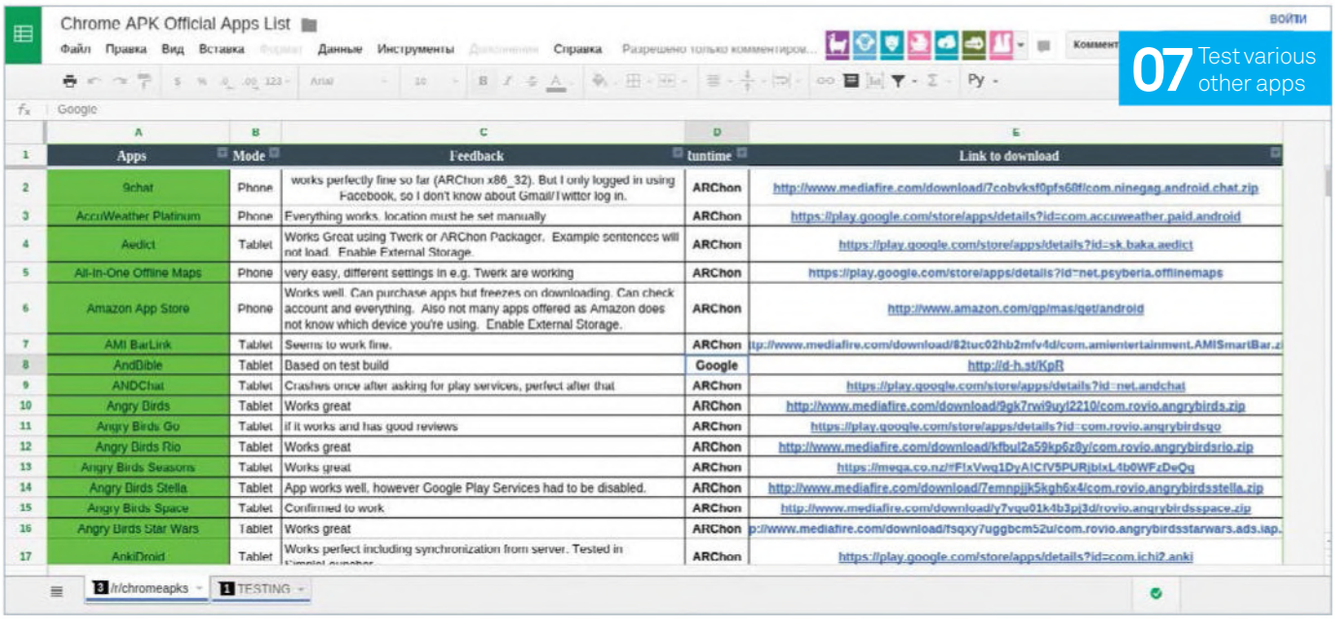
07 Test various other apps

Not every Android application will work but most will. However, take note that if an app relies on camera, gyro or other hardware module, which doesn't exist in a software mode, the app will malfunction or won't start at all. For this reason, benchmarking tools (eg AnTuTu), Instagram, games like Asphalt and several others will not work. Google Services and everything that depends on it will also fail to work. Luckily, though, sound and microphone are supported very decently, thus enabling you to enjoy Skype, various games with talking buddies and many more.

It is also possible to launch an unlimited number of Android apps in the Chrome browser, so explore and see what's out there. However, remember to be aware of the CPU load, which can often be extremely high.

Package apps yourself

There's an app on Google Play called ARChon Packager (**bit.ly/1ld5kol**) that enables you to generate Chrome packages straight from your phone. Simply use this app to browse through the list of other apps on your phone – both the apps you've installed via Play and any that you have manually sideloaded onto an SD card – and then select to zip everything up into a ChromeAPK folder on your phone's storage. It helps speed things up a little!



Apps	Mode	Feedback	Runtime	Link to download
9chat	Phone	works perfectly fine so far (ARChon x86_32). But I only logged in using Facebook, so I don't know about Gmail/Twitter log in.	ARChon	http://www.mediafire.com/download/7cobvksf0pfs60f/com.ninegag.android.chat.zip
AccuWeather Platinum	Phone	Everything works, location must be set manually	ARChon	https://play.google.com/store/apps/details?id=com.accuweather.paid.android
Aedict	Tablet	Works Great using Twerk or ARChon Packager. Example sentences will not load. Enable External Storage.	ARChon	https://play.google.com/store/apps/details?id=sk.baka.aedict
All-In-One Offline Maps	Phone	very easy, different settings in e.g. Twerk are working	ARChon	https://play.google.com/store/apps/details?id=net.psyberia.offlinemaps
Amazon App Store	Phone	Works well. Can purchase apps but freezes on downloading. Can check account and everything. Also not many apps offered as Amazon does not know which device you're using. Enable External Storage.	ARChon	http://www.amazon.com/gp/mas/get/android
AMI BarLink	Tablet	Seems to work fine.	ARChon	ttp://www.mediafire.com/download/82tuc02hb2mfv4d/com.amientertainment.AMISmartBar.z
AndBible	Tablet	Based on test build	Google	http://d-h.st/KpR
ANDChat	Tablet	Crashes once after asking for play services, perfect after that	ARChon	https://play.google.com/store/apps/details?id=net.andchat
Angry Birds	Tablet	Works great	ARChon	http://www.mediafire.com/download/9gk7rwi9uyl2210/com.rovio.angrybirds.zip
Angry Birds Go	Tablet	if it works and has good reviews	ARChon	https://play.google.com/store/apps/details?id=com.rovio.angrybirdsgo
Angry Birds Rio	Tablet	Works great	ARChon	http://www.mediafire.com/download/kfbul2a59kp6z8y/com.rovio.angrybirdsrio.zip
Angry Birds Seasons	Tablet	Works great	ARChon	https://mega.co.nz/#!FIxVwq1DyA!CfV5PURjblxL4b0WFzDwQg
Angry Birds Stella	Tablet	App works well, however Google Play Services had to be disabled.	ARChon	http://www.mediafire.com/download/7emnpjjk5kgh6x4/com.rovio.angrybirdsstella.zip
Angry Birds Space	Tablet	Confirmed to work	ARChon	http://www.mediafire.com/download/y7vqu01k4b3pj3d/rovio.angrybirdsspace.zip
Angry Birds Star Wars	Tablet	Works great	ARChon	p://www.mediafire.com/download/tsqxy7uggbcm52u/com.rovio.angrybirdsstarwars.ads.iap.
AnkiDroid	Tablet	Works perfect including synchronization from server. Tested in	ARChon	https://play.google.com/store/apps/details?id=com.ichi2.anki

Above The upper part of this table (follow the link at the end of Step 4) contains titles proved to work. They're already packed for you

08 Tips to get around

Once you finally have your Android app running, it's time to have a play around with it. Use Ctrl+Escape to emulate the Menu button. For the rest of the controls, use your mouse and keyboard – for example, to swipe across the screen, simply click and drag your mouse. Touch display is not supported on desktop PCs but does work on Chromebooks, if you happen to have one.

Once it's installed and run for the first time, an extension will create a menu entry and will soon display in your start menu. Entries like this are perfectly supported by all desktop environments in Linux. Doing a cold start of an application from the menu does invoke a lot of Chrome stuff, but everything runs quietly in the background without showing you any browser windows, and it feels like you're using a desktop-class application at the same time. It's a great solution for rescuing a favourite app from your phone screen!



Left It seems there are three ways to run this game in Linux: with Archon, in the virtualised Android-x86 or using a PC version via Wine

Android emulation

Why stop at running the apps when you can run the whole operating system instead?

Archon isn't the only choice for running Android apps in Linux. Why not deploy a whole Android OS inside your Linux host? If that idea suits you, take a look at the Android-x86 project (**www.android-x86.org**), which is an unofficial port of the Android OS for Intel-based computers. It can run on your PC as a normal system but its hardware support isn't perfect, so the best way is to install it inside a virtual machine. Go ahead and prepare the Virtualbox/QEMU/VMWare player, download the latest Android-x86 ISO (4.4-r2 at the time of writing) and install it as you would a regular Linux distribution.

Android-x86 shares many benefits with Archon and boasts many features. It supports OpenGL acceleration, external storage access (SD cards and USB sticks) and can sync with your Google account. Inside our test Virtualbox environment, Android-x86 performed well – most apps were responsive and stable. The only minor discomfort was introduced by applications that use landscape mode. Obviously you can't rotate your desktop LCD screen each time you launch such an app, so a workaround could help. That's why we'll rotate the host's screen. Find out the name of your display output:

```
xrandr -q
```

Then use it to rotate to the left (HDMI1 used for the example):

```
xrandr --output HDMI1 --rotate left
```

... and bring back to normal mode:

```
xrandr --output HDMI1 --rotate normal
```

For convenience, assign these commands to shortcuts and manage your screen orientation as if you have a magic wand.

Tether Raspberry Pi to an Android device

Need the internet on your Pi on the go? Try out a physical tether to your Android device for instant online access



The portability of the Raspberry Pi is one of its most lauded features and you can get many different accessories to help aid this portability. Mini screens, mini wireless keyboard and mouse combos, portable batteries and more can get you out and about, but the Internet is a stumbling block that you can't easily fix with an accessory. What you do also usually have with you is an Internet-connected magic pocket box called a smartphone that, with a bit of know-how, you can connect the Pi to and steal some Internet from. Over the next two pages we will impart this know-how to get you using your Raspberry Pi on the Internet when you're on the go.

01 The easy way

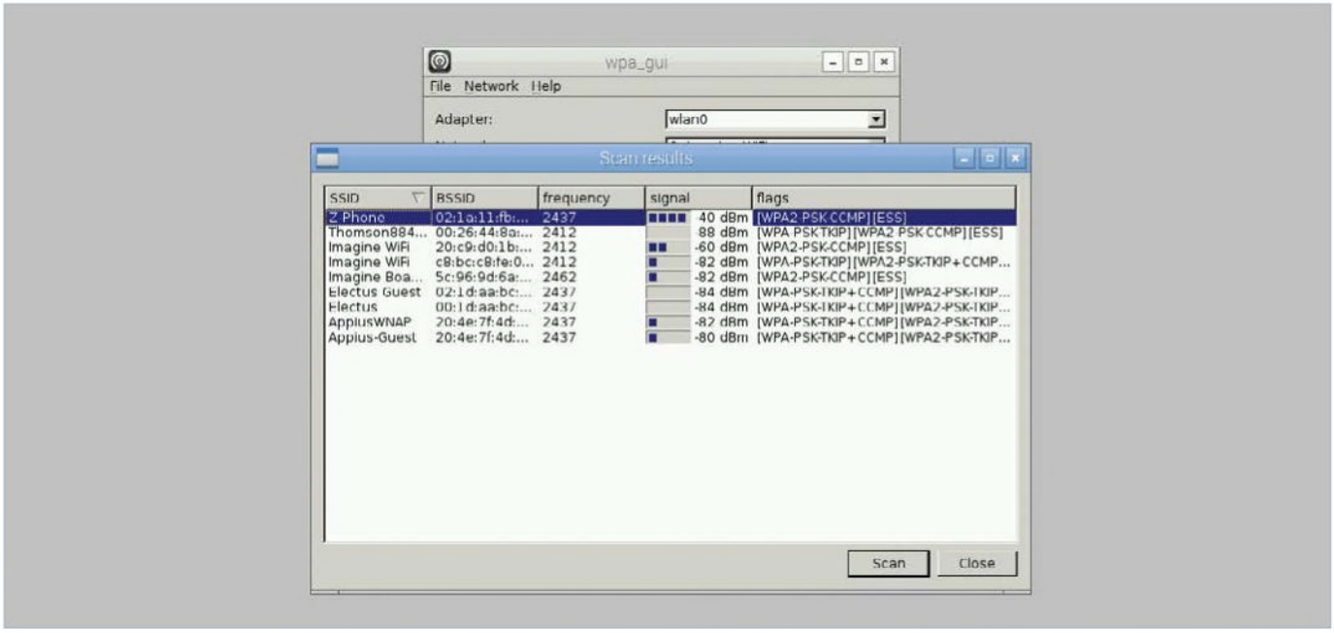
A lot of smartphones now have a Wi-Fi hotspot feature, which the Raspberry Pi can easily attach to. First of all, turn the hotspot on and then boot into the Pi. Connect a wireless dongle and open up the wpa_gui in Preferences>Wi-Fi Configuration.

02 Scan for device

Click Scan to open up the scan window and then select Scan again from inside there. It should pick up your device – connect it as you would to any Wi-Fi network and the Pi will remember it for when it needs it next.

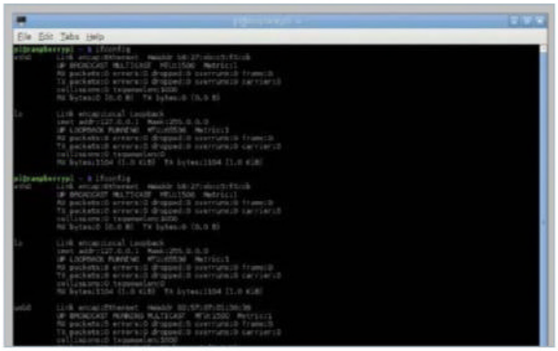
What you'll need

- Android device
- USB cable



03 Set up tether

First connect your phone to your Raspberry Pi via a USB cable – depending on the amount of power your Pi has, it might have trouble charging your phone but it will still let you tether. In the tethering menu you can now activate USB tethering.



04 Check connection

Your Android device will create an interface known as eth0 on the Raspberry Pi. You can check to make sure this is happening, and that it will let you tether, by opening up a terminal and typing the following:

```
$ ifconfig
```

05 Quick connect

You can connect from the terminal right now to access the Internet. You should be able to do this by typing the following into the terminal:

```
$ sudo dhclient usb0
```

This will automatically grab any available IP address that your phone will give to it.



Above It's usually easy to figure out which device is your phone – set it right next to the Pi and it will be the one with the best signal!

06 Test connection

There's a few ways to test your connection. We'd usually stay in the terminal and ping **www.google.com**, which you can do, or you can click on the browser and see if it loads the page.

07 Save the settings

Once you reboot your Pi, it won't remember to automatically connect to the phone's tether. However, we can add an entry to its config so that it will try and do this in the future. From the terminal use:

```
$ sudo nano /etc/network/interfaces
```

08 Interface settings

Here you'll find all the current network settings – yours might look different from ours depending on if you have added any fixed wireless settings or passthroughs. Using the same syntax as the eth0 line, add:

```
iface usb0 inet dhcp
```

09 Tether on the go

After a save and reboot, your Pi should now automatically connect to your phone, whether it's via Wi-Fi hotspot or a physical connection. It may draw a little more charge than usual while tethering, so be sure to keep an eye on your battery level.

Mobile data

Using your Pi on your mobile phone will eat up data much faster than browsing on your phone normally is. We suggest not doing a full software, distribution or firmware update if you don't want to spend a fortune on data. You can also set limits on the amount of data used on your phone to save yourself any problems, and a physical tether will allow you to connect via the phone's Wi-Fi if that's an option.

Spin your own Debian

Use Debian Live System tools to learn how to spin a new Debian system customised for you

Debian 8.0 'Jessie' is out now. It is an impressive and useful update, so now, you can either use it as your stable distro, switch to 9.0 'Stretch' as your new rolling release or create your own custom Debian.

Here, we're going to look at creating a custom Debian ISO using the Debian Live Systems project. With the project and website, you can create your own custom version of the distro to deploy as you wish around an office or in your own home. The benefit of creating your own spin is the ability to include specific packages that are particularly relevant to your needs, have it work on specific architectures, and generally make it much more suited to your needs.

We'll be using the online tools available to create this custom image but they're very similar to the ones that exist within Debian, which will enable you to create your own spin once you decide to go a little more hardcore and edit it from the distro itself.

Resources

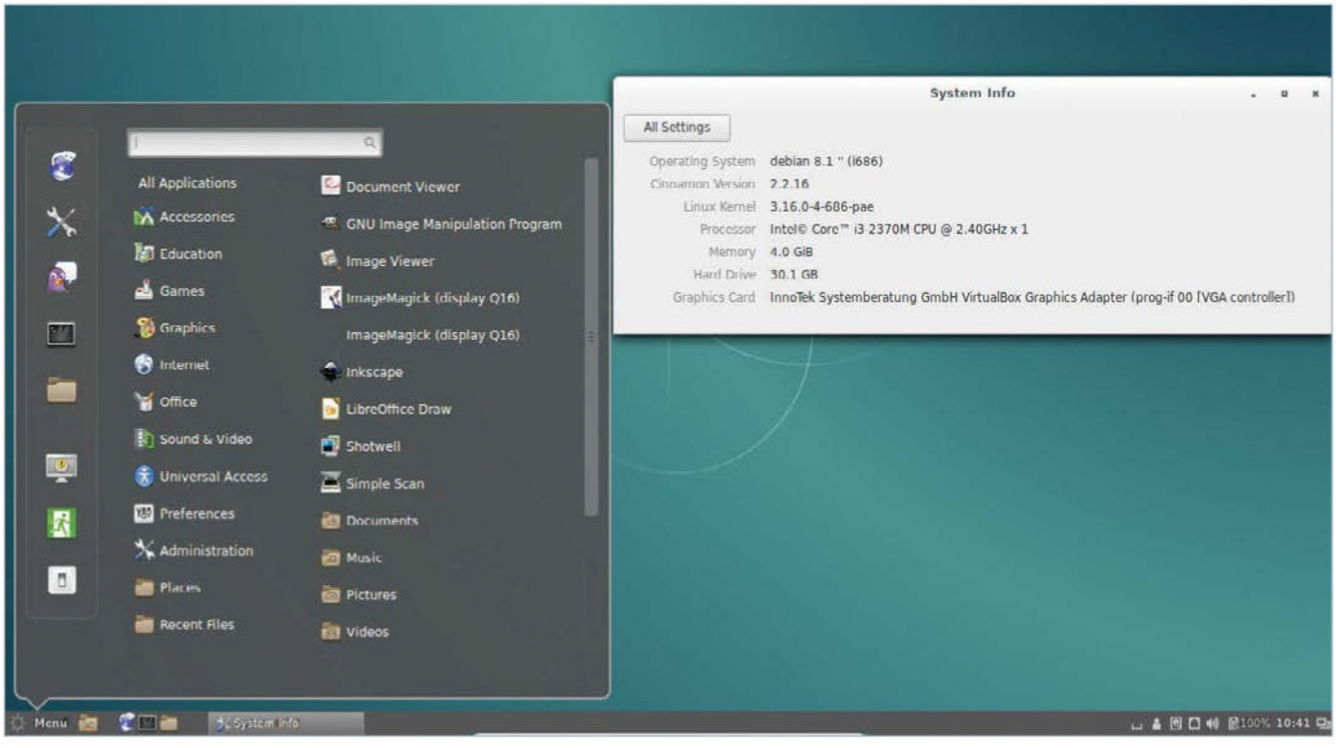
Debian Live builder
live-systems.org

01 Find the builder

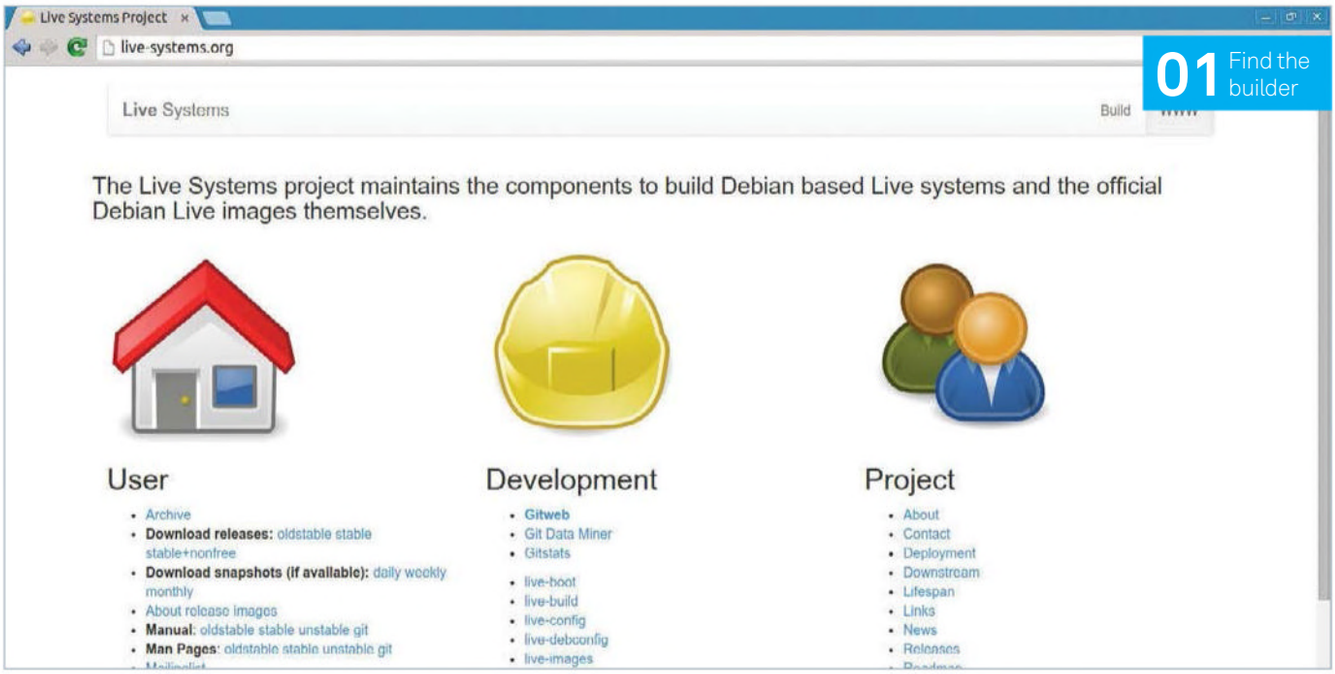
For this tutorial we will be using the Debian Live System builder. This is not only software that you can actually use on Debian, but also it has been applied to a web service. We are going to use the web version of this, which makes the setup slightly easier to parse and generally understand. You can have a look at it by heading over to the following address: **http://live-systems.org**.

02 Start the build

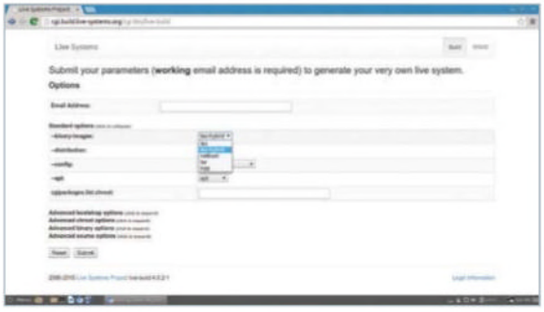
From this page you can read up on the range of different uses for the software, including development info and old versions of the build software and images used in it. For now, we are actually interested in building a distro, so click on the Build tab that's located on the top bar and select the Debian option to get to the interface where we can customise the build to our liking.



Above Easily create a custom Debian through your browser using the tools that are built into the distro



01 Find the builder



03 Select an image type

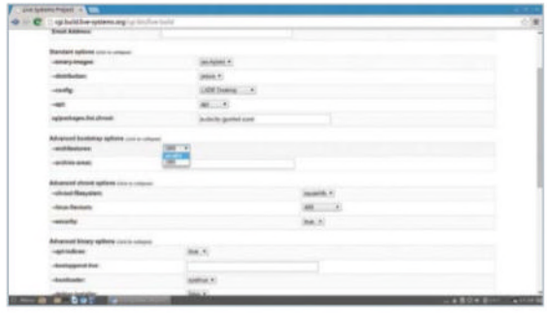
After putting in your email address, you have a selection of image types to use. ISO is a pure image of the distro, able to be used for live booting from a CD or USB device only. Netboot is the kind generally used in net booting, which is over the network live boot/installation. Isohybrid combines both CD ISO live booting with the ability to use it to live boot off other live mediums (such as a USB stick), separate CD ISO and HDD(/USB) images and a compressed version. Isohybrid works for most situations.

04 Type of Debian

You have a bit of choice on what kind of distro you can create for the ISO. You can select between Debian Testing (currently Stretch) and Sid for the image – Sid is the unstable image and you should probably stick with Testing. Otherwise, you can also choose the desktop environment to be used by default by the system – there's a wide variety, along with having the option for no desktop at all.

05 Default package choice

You can set the ISO to have certain packages installed as part of the default package list using the 'cgipackages.list.chroot' field. All you need to do is add the package names to the list separated by a space – ensure you get the exact package names correct though, so perhaps check the spelling in a standard live booting Debian before you add it to the list. There's a limit of 255 characters, so make sure to add only the essentials.



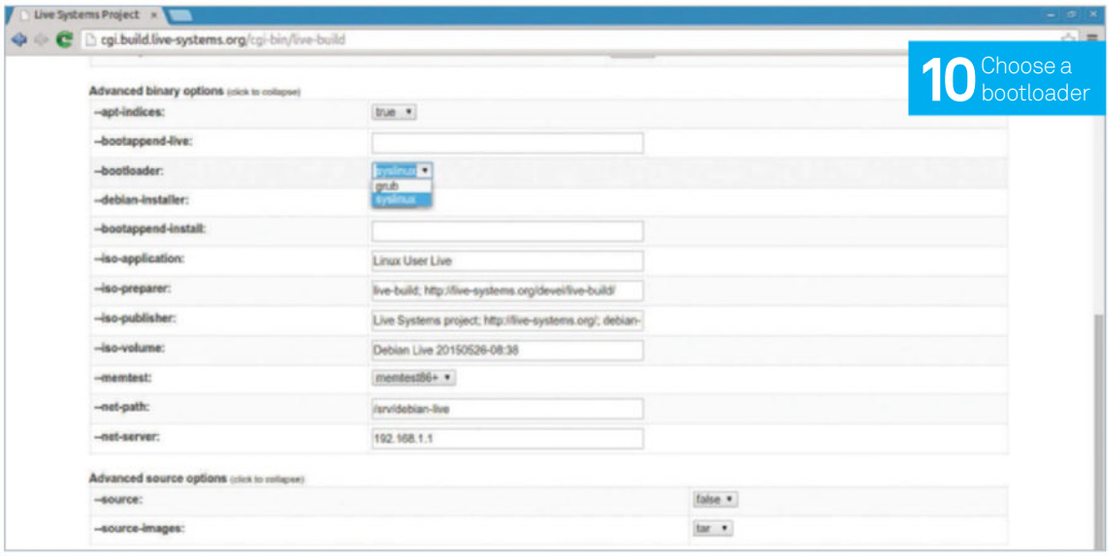
06 Architecture choice

Choosing whether to have a 32 or 64-bit ISO is entirely dependant on the use cases you have planned. A 32-bit ISO (i386) will be more universal, working fine on older systems as well. This can be good for general troubleshooting or maintenance. For getting the most out of a system though, a 64-bit ISO (amd64) is preferable. You can always go back and create a second ISO with a different architecture if you desire, though.

Above There's plenty of documentation to help you work with the system's tools

A more manual process

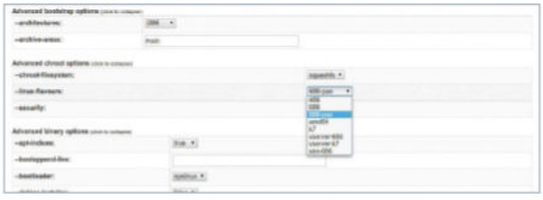
The live system builder uses software available in Debian that can be used to create your ISO using your current setup as a base. It uses the same commands and option as the web version and builds it locally on your system. The package is called live-build.



Right You get fine control over your build, even down to the bootloader

Other distro builders

Debian isn't the only distro you can customise – Fedora and Ubuntu have live builders that you can use, albeit in various states of maintenance. There's also SUSE Studio, which is another online builder that uses all of the SUSE and openSUSE distros as a base. You can find that here: **susestudio.com**.



07 More architecture choices

As well as a basic architecture choice, you can drill down into the sub-architectures to better optimise your distro for the task you need it for within linux-flavours. If you're doing 64-bit, the standard amd64 is all you really need to concern yourself with. For 32-bit/x86 builds, there are many more choices. For much older processors 486 will work, but won't be able to make full use of their power. In addition, 686 won't work on older tech, but it will work on all modern machines. Choose 686-pae if you want to properly use 4 GB of RAM as well.

08 Chroot filesystem

The root filesystem that you actually boot from can be modified in the chroot-filesystem option, right above the linux-flavours that we just talked about. It's set by default to SquashFS, which is the current standard, but if you need it to be another filesystem type for older or different machines, you can choose ext2 or plain.

09 Extra boot options

In the advanced binary options we can start adding extra options for our specific use cases. You can mostly keep these at their defaults, but there are a few options you could feasibly change to get the most out of it. First of all is the 'bootappend-live' option: this enables you to add any extra boot options to the distro you're creating. Setting a resolution, running in software rendering and any other boot option you'd want can all be added here.

10 Choose a bootloader

Live systems tend to use syslinux for live booting, although it can depend on what kind of images are in the ISO. Multiple arch or kernel versions are easier to launch via GRUB. We won't be able to do that in this image, but if you're having problems booting then you could always try building the image with the different bootloader. For now, we recommend using syslinux and then changing it to GRUB if it's not working in your specific use cases.

11 Choose installer type

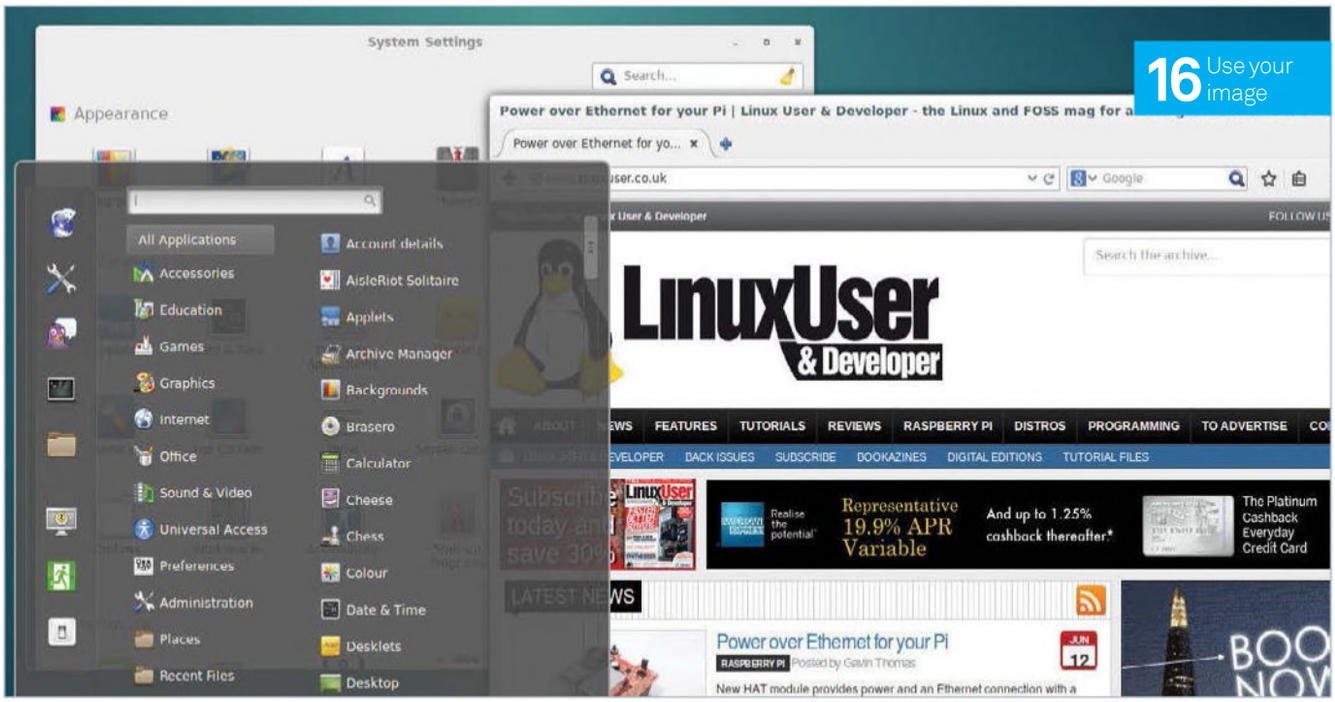
There are three choices for the installer in the ISO. First of all, you can have none and it just boots into a live environment. Secondly, you can have it as an option other than live-booting, so that you can go straight into installing the image if you know it's exactly what you want. Lastly, the live option provides for a live install from the live environment. We're choosing live, as it enables us to use the distro and then install without rebooting.

12 ISO options

The ISO labelled options are all for just labelling the ISO in your own way. You can leave these be and it won't affect anything, or change them if you plan to distribute your version of Debian and want some extra info to be in there. The volume will appear on the actual ISO name, with the application being used as the name of the distro elsewhere.

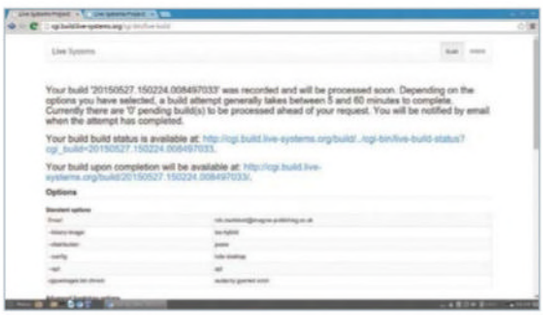
13 Final binary options

Finally, you can set a few extra options such as whether or not memtest is included in the ISO, and the location to look for the Netboot ISOs for booting with the net-path and net-server is available to tweak. These last few you won't need to change for a normal ISO, but if you're making a netbooting distro then you'll have to make sure you have the infrastructure set up and know what needs to be added to these fields.



14 Source files

If you also want a source version of the distro once it is made, you can set the source option to true. By default, this will create a TAR file with the source of the distro, but that can be changed to a couple different options if you wish. For the time being you can keep it set to false, but in the future if you find that you need the source separately, it is definitely a good idea to keep this option in mind.



15 Build your distro

Double-check everything one last time and then click submit. You'll be presented with your options as a run-down, so you can try to remember them, and two links that you can use. One will let you check the process of the build, while the other is the link to the actual ISO itself. The process to build is supposed to take up to an hour, but in our tests it did take longer. Remember to download all the files you want as soon as possible because they will be deleted after 24 hours.

"The process to build is supposed to take up to an hour, but in our tests it did take longer"

16 Use your image

Once you get notified that your image is ready, download it and anything else that you want. Load it into a virtual machine or onto a live-booting medium and then check out your new distro. Make sure that any packages you wanted have installed by looking in the menus, and that you have the right architectures and options in the build itself.

Above Keep note of your exact setup so that you can check your distro once it's live booted

17 Install your image

If you plan to install this distro on your system then you can do so from inside the live environment, as we selected that option during the build. If you're having problems with it, try the other install options in the build until it works as planned. You can also use a command line and graphical installer from the boot menu if you want to skip live boot.

18 Use your Debian!

Once you've checked to make sure your new image is working, you can start using it properly. As Debian updates, so too will the system you have, and you can get zsync ISOs to use in updating if you don't have access to the Internet. You can also freely distribute it as you wish, as it's also free software licensed under the GPL.

Build a WebKit browser

Learn how to get WebKit built and running on a Linux system to develop browsers

For a while a few years back, it seemed like every single new browser was being made in WebKit. While Apple's Safari browser had been using it for years, Google's Chrome and the Chromium project seemed to launch it into the spotlight and result in desktop and mobile browsers built on the technology.

While the standard source is optimised for development on OS X and Windows, there is a branch of it specifically for Linux: QtWebKit. With this source you can continue to develop the engine for use on Linux or you can build your own browser using WebKit as a lightweight rendering engine.

In this tutorial, we will show you how to get WebKit set up on your system, along with some pointers on how to construct a browser using the source so that you can then go ahead and begin creating a custom project.

Resources

WebKit
webkit.org

Qt 5
bit.ly/1K5QTGD

Ubuntu 12.04 or higher

01 Grab the source code

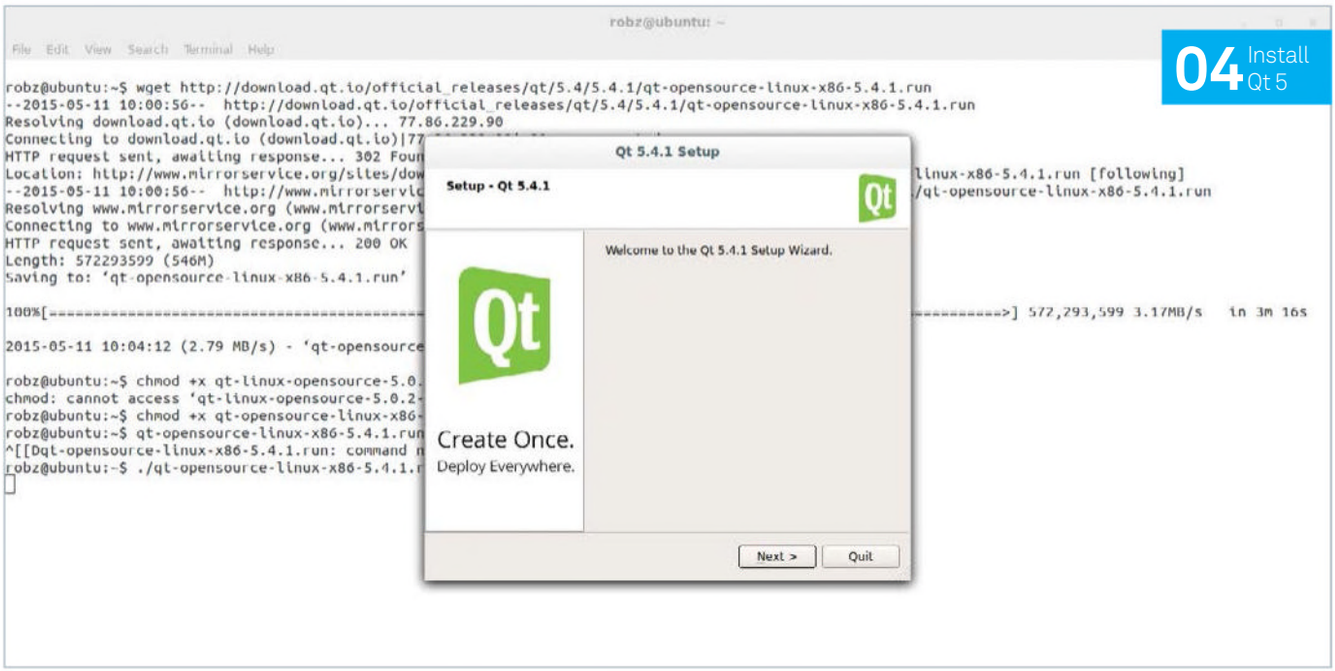
We need to first get the source code for QtWebKit, which is part of the normal WebKit source tree. Open up a terminal and **cd** to the place where you like to keep your sources, or create a new directory for it with **mkdir**. Sync the source locally in the terminal with:

```
$ git clone git://gitorious.org/webkit/webkit.git
```

The source will take up just over 4 GB of space, so make sure you have space and perhaps something to do while you wait.

Below Create a browser like Chromium using the WebKit browser engine, Chromium's original base





04 Install Qt 5

02 Get the staging branch

This step is optional, but you could also look at tracking the staging branch specifically for the Qt port. To do this you need to first **cd** into the WebKit directory that was just created. From there, you can fire off the following commands:

```
$ git remote add Qtwebkit git://gitorious.org/
  webkit/Qtwebkit.git
$ git fetch Qtwebkit
```

However, the current release of the Qt port files is in the normal WebKit source that we downloaded.

03 Get the Qt 5 source

We need to build Qt 5 properly so that our WebKit can run and be developed in the correct way. We first need to download the files to install Qt 5, which can be found here: **www.qt.io/download-open-source**. You can also download the installer file in the terminal using something like:

```
$ wget http://download.Qt.io/official_releases/
  Qt/5.4/5.4.1/Qt-opensource-linux-x86-5.4.1.run
```

Remember to take into account the latest version of Qt 5 before you download.

04 Install Qt 5

Once it's downloaded, we can get ready to install it. First of all, elevate the file so you can execute it using:

```
$ chmod +x Qt-opensource-linux-x86-5.4.1.run
```

> **"If you're using a more recent version of Ubuntu, you may encounter some problems when working with Qt code"**

Remember to change the version on this line to be the one you downloaded. When you have done that, you can install it using the following:

```
./Qt-opensource-linux-x86-5.4.1.run
```

This will bring up a graphical installer – follow the instructions to install Qt 5.

05 Setup OpenGL

If you haven't already installed the OpenGL libraries, you should do so now. They can be installed using:

```
$ sudo apt-get install mesa-common-dev
```

If you're using a more recent version of Ubuntu, you may encounter some problems properly working with Qt code, so it can be prudent to install the following package as well:

```
$ sudo apt-get install libglu1-mesa-dev -y
```

If you start having problems with GL as part of this tutorial, installing this package may fix it.

Build essentials

If you're on a dedicated build environment, you probably already have the G++ compiler that is required for this build. If you don't, this can easily be installed in Ubuntu using the following:

```
$ sudo apt-get
install build-
essentials
```

You'll need to do this as soon as you can in this tutorial to make sure everything is properly set up.

Qt Creator

While we're building this in a command line environment, you can also build it in the graphical Qt Creator software. It takes a bit more to get it to run in there, though – you'll have to edit bits of the source and use a custom build command for it to actually start. You can look into how to do this here: **bit.ly/1IvzbM5**.

06 Set the Qt paths

Before we can continue building WebKit, we need to set the correct paths for the Qt development software. We first need to set QTDIR to the location of the Qt installation. Do this by exporting the path with:

```
$ export QTDIR=[Install directory]
```

Then make sure that the Qt 5 qmake is the first in the PATH. Use the following to do this:

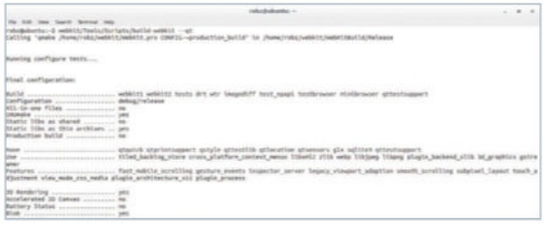
```
$ export PATH=$QTDIR/bin:$PATH
```

07 Get any extra dependencies

Depending on your development environment, we may need to add extra dependencies to make sure everything will run and compile correctly. Ensure that the following packages are installed just to be certain that the compiling goes smoothly.

```
$ sudo apt-get install bison gperf flex
libsqlite0-dev libicu-dev libxslt-dev ruby
```

There may be other packages you need and you can install them as you go, but these seemed to be the common absent packages in our tests.



08 Start to build WebKit

Finally, we can begin to actually build the QtWebKit source. Go to the directory that you've downloaded the WebKit source to and build it using:

```
$ webkit/Tools/Scripts/build-webkit -Qt
```

This will take a while, depending on your system. If there are any other errors or missing dependencies, it will stop and you may have to hunt down the libraries that it needs.

09 Launch a test of WebKit

Once everything is compiled (and it will take a while depending on your system), you can run this very basic version of WebKit using the following:

```
$ Tools/Scripts/run-launcher -Qt
```

This is the QtTestBrowser, which is a very quick implementation of WebKit as a browser. You can look through the files to get an idea of how it uses WebKit.

10 WebKit use explained

There are some basic principles to the way WebKit handles data to render. This is handled via the WebCore engine and is made up of specific systems: the Document Object Model (DOM) tree, the render tree and the style tree. These three parts help to render each webpage efficiently and therefore we will break them down and discuss them in more detail over the next few steps.

11 How the DOM tree works

Each webpage is parsed into this DOM tree of nodes, all referred to be the base class of Node.h. Of these nodes, there are three that are relevant for actually rendering data: Document.h/HTMLDocument.h, which is the root of the tree; all of the tags from the HTML or XML are kept in Elements.h, and can be queried whenever you need them; finally, Text.h contains all the raw text that goes between the elements – in other words, the content on the page that is actually readable.

12 Structure of the render tree

The rendering nodes of the render tree mostly correspond to the nodes in the DOM tree, albeit with a few extra objects and nodes that don't exist in DOM. These are kept in RenderObject.h. The RenderObject for a DOM node can be obtained using:

```
RenderObject* renderer() const
```

... which can be more usefully used as:

```
RenderObject* firstChild() const;
RenderObject* lastChild() const;
RenderObject* previousSibling() const;
RenderObject* nextSibling() const;
```

13 Create the render tree

Renderers are created when a DOM node is attached to a renderer. The information in the node will determine what kind of renderer to use, including not creating it if certain conditions are met. It's a top-down recursive operation – all descendants have renderer nodes created after their parents. You can call the attach method with:

```
void attach()
```

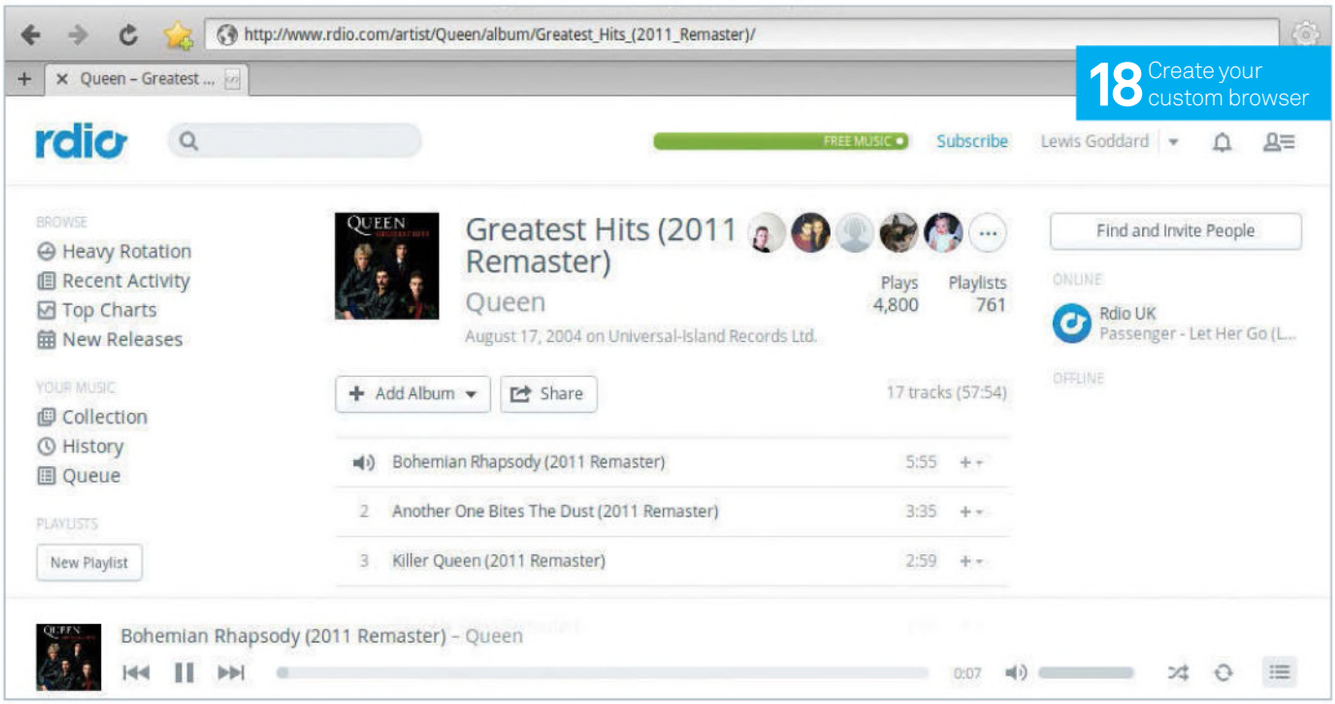
... on the DOM nodes to begin the rendering process and get it fully underway.

14 Destroy the render tree

This is related to creating render trees by calling the opposite command, detaching DOM nodes from the renderer:

```
void detach()
```

This destroys the render tree when a tab or window is closed, and ends the need to see the info present in the DOM tree.



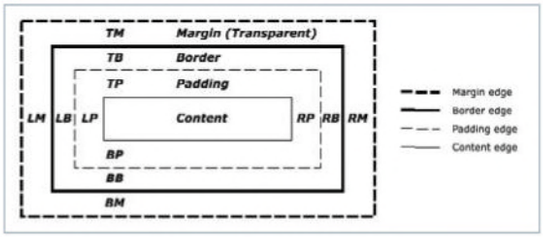
15 Use style information

While attaching DOM information to a renderer, the element is queried for CSS/style information and the resultant data is kept in RenderStyle.h for when the webpage requires this rendering. All supported style properties can be queried via RenderStyle.h which then connects it to an attached renderer with:

```
void setStyle(RenderStyle*)
```

This style can be changed on the renderer, but otherwise it will stay the same until destroyed. Styles can be accessed using:

```
RenderStyle* style() const
```



16 Work with RenderBox

This is the subclass that handles any objects that use the CSS box model. This includes objects with borders, padding, margins, width and height (a couple of non-box model will subclass from RenderBox right now, but that will be fixed in the future). The diagram for this step illustrates the parts and structure of the CSS box model.

17 Read relevant widths

To see the info from the object, call the raw data with:

```
int marginTop() const;
int marginBottom() const;
int marginLeft() const;
int marginRight() const;
```

```
int paddingTop() const;
int paddingBottom() const;
int paddingLeft() const;
int paddingRight() const;
```

```
int borderTop() const;
int borderBottom() const;
int borderLeft() const;
int borderRight() const;
```

The rest of the style information is stored similar to this.

18 Create your custom browser

With enough time and effort, your can use WebKit as an engine for your own very powerful, very sleek browser. It won't have the sync abilities of Chrome unless you own a ridiculously far-reaching online infrastructure, but you can easily make it so that settings of files can be synced between systems using cloud storage.

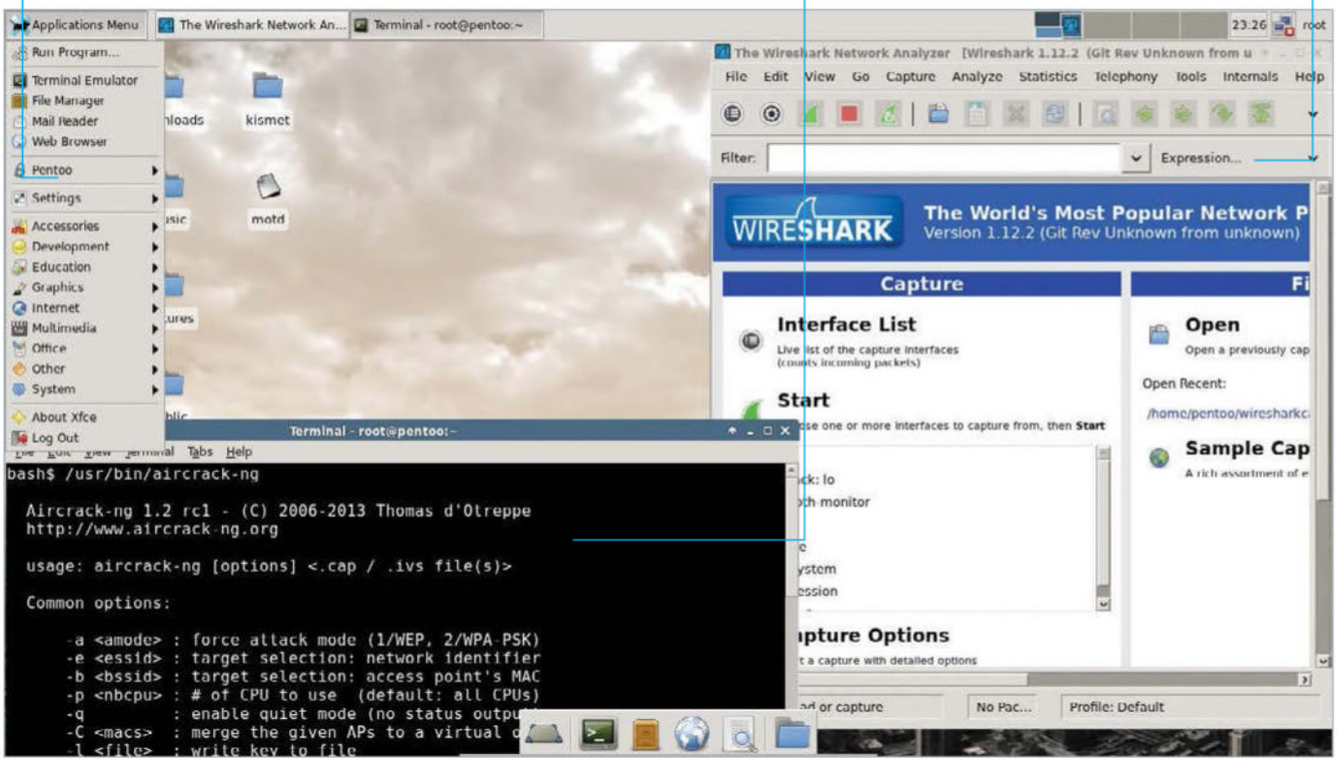
There is a lot more to learn with WebKit, but we have presented you with just the basic steps to understanding how it works. No go forth and explore some more!

Above Here's one of the example browsers that we worked up during our tests for this tutorial

There are a range of excellent pentesting apps that are all installed by default

Use aircrack-ng to figure out just how secure your wireless network really is

Wireshark can keep track of the traffic in your system so you can find out if there are any problems



Network penetration testing with Pentoo

The Gentoo-based utility distro can find vulnerabilities in your network

Safety is a big preoccupation for all computer users, not just those on Linux systems. It's important to know how to shield yourself and your systems from attacks, and now we're going to look at the problem from a slightly different angle: how someone would attempt to attack your system.

White hat or ethical hacking is an important step in any security process, and we're going to take a quick look at probing your own local network to try and figure out any problems you might have. There are a few different tools and distros that can aid you in this, but today we are going to focus on Pentoo.

Pentoo is less known than Kali or Backtrack Linux, but it's by no means a poorer product. Built on Gentoo, it can be used perfectly well live and can be installed for a more permanent testing rig. While it has a full suite of pentesting software, we'll be concentrating on some of the network testing apps for the purpose of exposing any vulnerabilities in your network.

Resources

Pentoo www.pentoo.ch





01 Grab and load up Pentoo

Get the ISO of Pentoo from the distro's website (**www.pentoo.ch**) and write it to disc or USB. Reboot into the distro and either press Enter if you use the Colony's English or type 40 for the Queen's variety. Use **startx** at the command prompt to then launch the desktop.

02 Explore applications

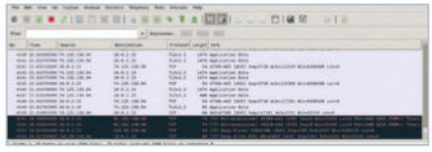
All the analysis and pentesting packages are kept in the Pentoo section of the main menu. Pentoo can be used for all manner of testing from computers to networks to websites and more. For now, we're interested in Wireshark, which is in the Analyzer submenu.

03 Use the interface

Wireshark is presented on a web-like interface as you interact with the backend of the software. You can begin capturing the traffic from any number of interface devices to see what exactly can be seen within the network.

04 More options

Before we start looking at the data, we can also make some more advanced settings on what the capture will grab. The basic settings will get a lot of data while it snoops the network, but you can set where it stores the files and if they should be split up. For now though, click Start.



05 Capture basic data

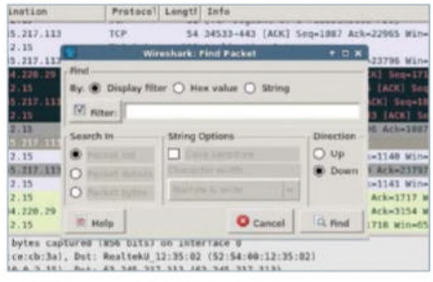
You'll start to see any data that crosses the interfaces with plenty of information on the packets, their origin and their destination. At a basic level you can see if there are any untoward packets being sent in or out – good for checking your own sites and LAN sites as well as the system in general.

06 Filter your data

For basic capture data like this, there will be a lot to sift through by default. You can filter it while it's running or stop it to inspect anything you might have been trying to do during a test. Apply regular expressions to narrow anything down.

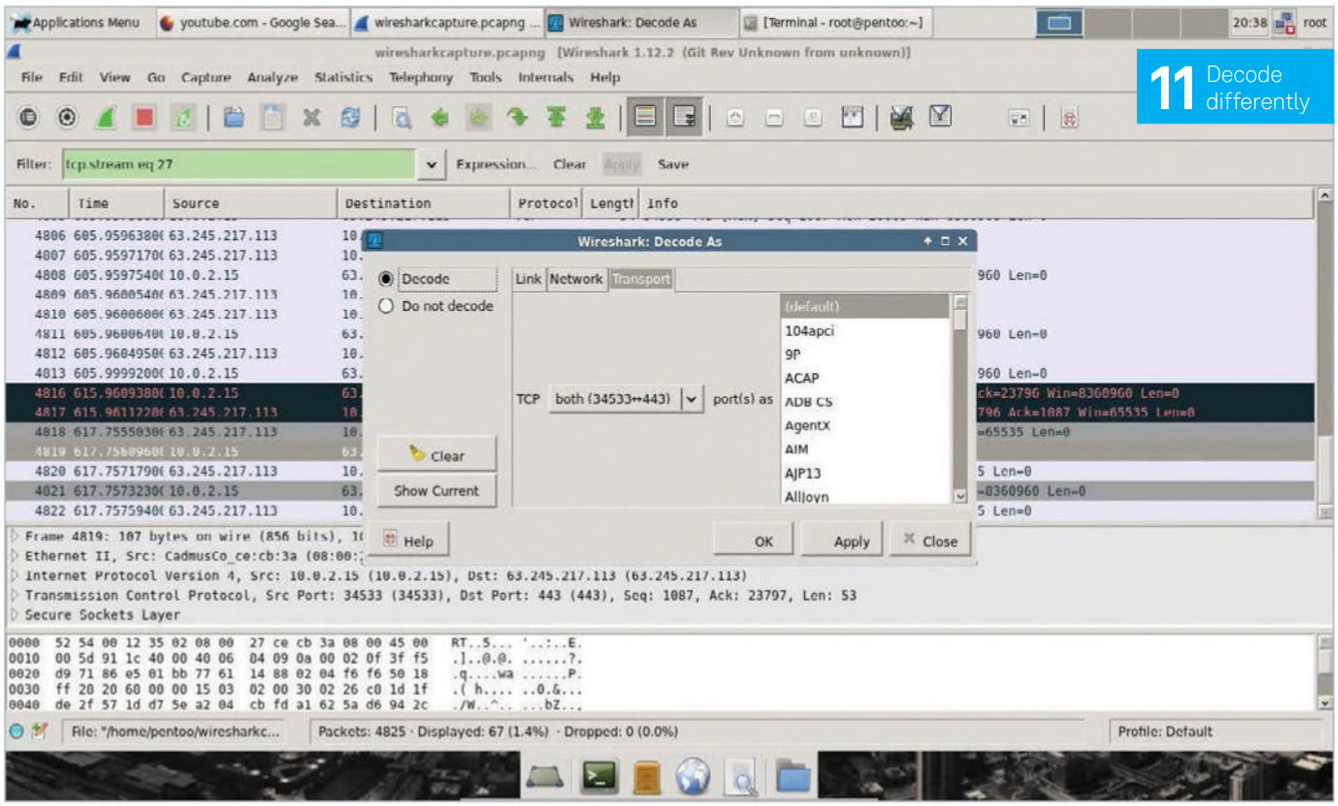
07 Save and retrieve

Captures you've made can then be saved to file as you would with any normal type of file. The benefit of this is that you can reopen it in the future in the same capture window, to then search through in case you need to either compare something or remember a packet.



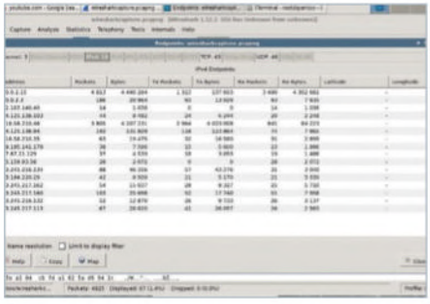
08 Find individual packets

Sent a very specific packet during or as part of your test? There's no need to worry, as you can search for a known packet in the logs using the Find Packet tool to look further into the records. It requires accurate knowledge and data about the packet in question though, so you'll need to be well aware of what you sent. It's a good idea to always keep track of all the relevant info just in case.



09 Use VoIP tsracking

You can also see the VoIP traffic on a system under the Telephony menu on the tool bar. This will show the caller and receiver, what protocol they're using what kind of data is being transmitted and more.



10 Endpoint detection

One of the weaknesses in a network can be remote machines that access a network. When going through a capture, you can see what endpoints have been connecting to the network and filter out which ones are authorised or not. You can also set up a remote attack and see if it registers.

11 Decode differently

Sometimes odd packets and messages may occur on a different port that Wireshark has a problem translating. This is simple to fix, you just need to have a look at the package using a different protocol with the Decode As tool. It may just be a random connection but it could be something else which will definitely need sorting.

12 Wireless defence test

Pentoo has an excellent suite of software called aircrack-ng that can attempt to discover and break a wireless network. This software tries to sniff packets on the network to figure it out. To start we need to make out wireless card able to see the packets, so we need to use airmon-ng.

13 Employ promiscuous mode

Open up the terminal to use airmon-ng. Check ifconfig if you need to figure out the interface name of your card, and then turn it to the correct mode using something like:

```
$ airmon-ng start wlan0
```

14 Find an access point

Airmon will change your wlan to now be mon0, which is what we're going to use to try and find an access point. This is useful if you've tried to make your Wi-Fi hidden but it's also useful to see just how powerful your network is around a building. Start it with:

```
$ airodump-ng mon0
```

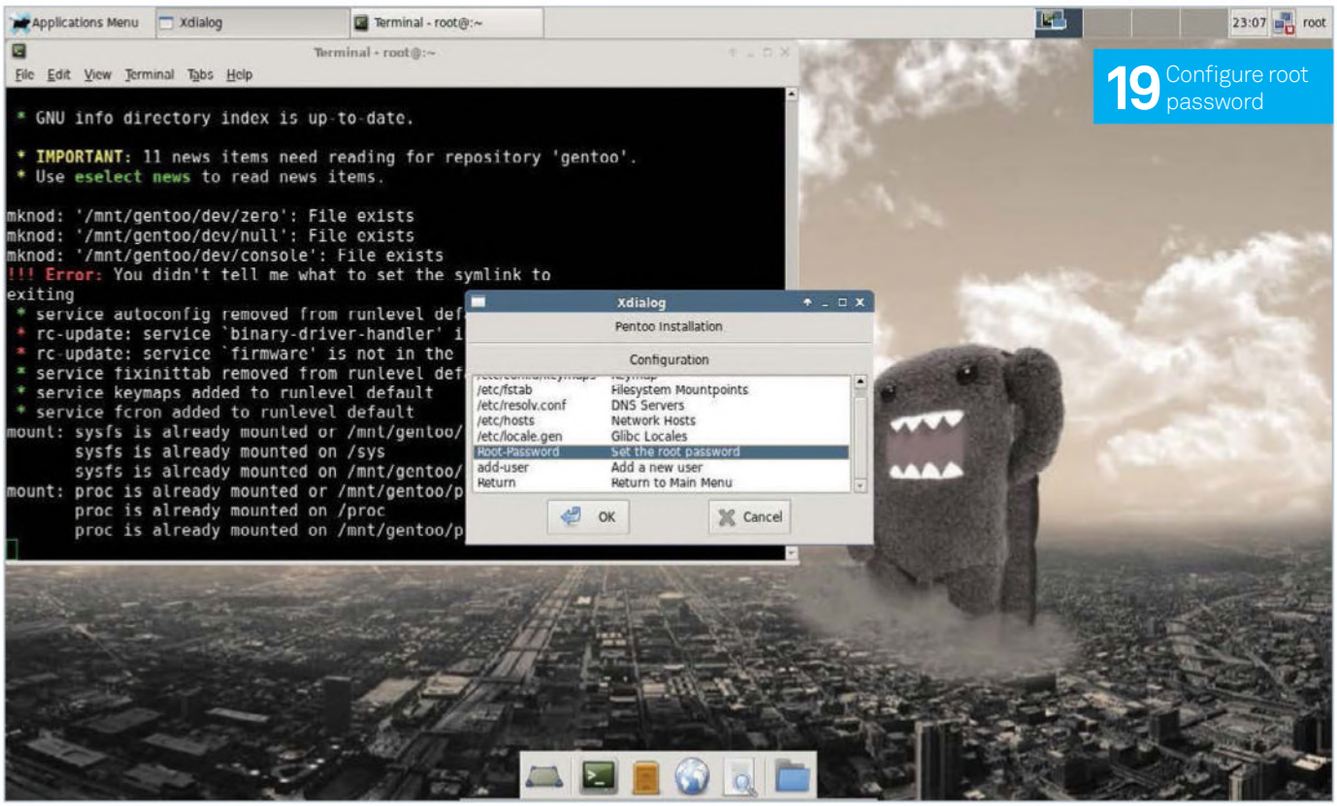


15 Test your passwords

You can now try and use aircrack-ng to brute-force your passwords and see if they're strong enough. The basic way of doing this is to use something like:

```
$ aircrack-ng -b [MAC address/BSSID]
```

This will try and crack the password on the access point. There are various options you

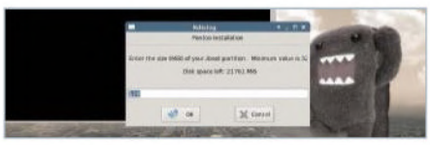


can use that will limit CPUs, focus on a specific password types and even bring in a list of dictionary words and common passwords. The latter is useful if you're checking out someone else's network for them. You can see more options in the main file.

"Pentoo has an excellent suite called aircrack-ng that can attempt to discover and break a wirelss network"

16 Install Pentoo

Need a more permanent version of Pentoo that you can plug into your system at a moment's notice? You can install the software to your computer with the installer, however it's not quite as simple as something like Ubuntu. Click on the installer to start.



17 Set hard drive

Option one has you set the hard drive options. It's a bit more involved as you directly set the boot size, swap and the storage. Its recommendations can be good but it won't enable you to do any advanced partitioning.

18 Copy the distribution

Working on the hard drive is the first step to the installation of Pentoo. So once the hard drive has been fully worked on, you will be able to perform the automatic install. Select option two and wait a while – it will unpack the files and install them and also ask if you would like to transfer any settings from your current setup.

19 Configure root password

Go to configure the system and start adding users and configuring the root password. Without the root password set, you could have great difficulty logging in once the installation has finished. Go back to the main menu, install GRUB as the bootload and then reboot.



20 New Pentoo

When that's all done and dusted, you can now boot into your fresh copy of Pentoo, able to be used to find and diagnose issues with your own networks and the networks of friends and family with great efficiency. As it's Gentoo, you'll have to understand how portage works to start updating, but it's very easy once you know how, and it doesn't take long at all to learn. You'll soon feel far more confident in the security of your network.

Build your own DEB and RPM packages

Replace your 'make install' habit and learn how to deliver Linux software like a pro

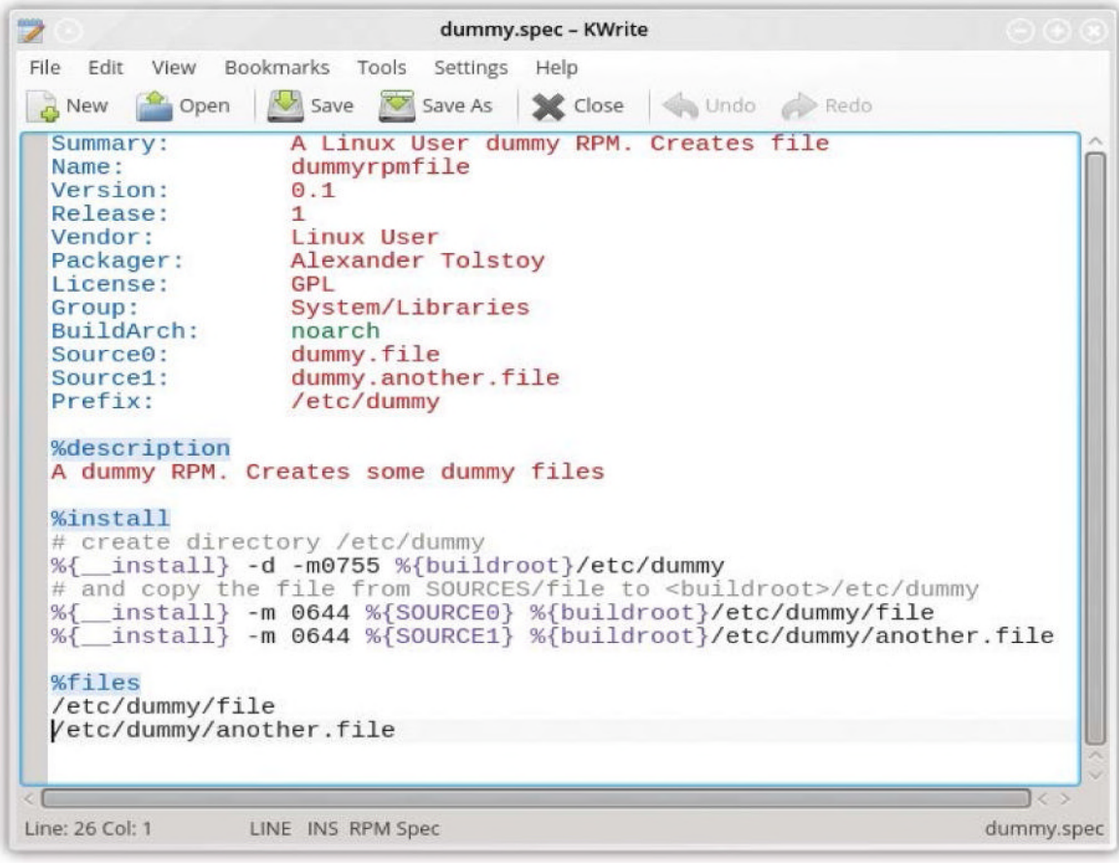
If you count the most prominent and well-known Linux distributions, you'll notice that nearly all of them utilise two software package types: DEB or RPM. The first one comes from the world of Debian and spreads on Ubuntu and dozens of its derivatives, while the RPM, originally created for Red Hat, is used in Fedora, Mageia, OpenSUSE and many others. Both worlds share the same approach: every file in a system must belong to a package, so the whole installation is a collection of binary packages.

Maybe you're already familiar with building Linux applications from source, or you just want to deliver a custom set of files or a binary app in the 'right' way – neat, clean and convenient. In this tutorial we will find out what it takes to create a custom DEB or RPM package and the ways in which you can benefit from maintaining everything in your system by using packages.

The tutorial naturally breaks into two parts, as Debian and Red Hat packaging systems are different and therefore require learning different sets of commands. However, as you will see a bit later, the procedure is really straightforward and easy to follow once you have got your head around just a few basic examples.

Resources

Access to your distro's official repositories



Right The spec file has an easy-to-read structure and a lot of system-wide macros, which you are advised to learn

From package to repository

If you decide to build your own packages, you may want to organise them into local repositories to use with a graphical software management tool. In the case of Ubuntu/Debian and their derivatives, you must complete four steps. First, install the dpkg-dev package. Next, put your .deb files into a directory of your choice. Then you will need a script to scan that directory and create/maintain repository index files; it can be a three liner:

```
#! /bin/bash
cd /path/to/debs
dpkg-scanpackages . /dev/null | gzip -9c > Packages.gz
```

Finally add a line to your /etc/apt/sources.list pointing at your repository. The line will look like this:

```
deb file:///path/to/debs ./
```

In Fedora/CentOS and various derivatives you'll need to create a repo with your RPM files. Start by installing the createrepo package (**yum install createrepo**) and then create repository metadata in the directory containing your RPM files:

```
createrepo /path/to/rpms && chmod -R o-w+r /path/to/rpms
```

After that, create a .repo file in the /etc/yum.repos.d/ directory. The contents of the file should comply with the simple template shown below:

```
[local]
name=<your_distribution>-$releasever - local packages for
$basearch
baseurl=file:///path/to/rpms
enabled=1
gpgcheck=0
protect=1
```

Yum repositories are also supported in OpenSUSE/Suse Linux Enterprise Desktop as well, and you can add them either with the YaST GUI software or via the command line using zypper, like this:

```
zypper addrepo -t YUM /path/to/rpms
```

It's really simple to create your own packages once you know how!

01 Why you may need to do it

Let us first list some common cases where packing your files into a package is preferred. To start with, your distribution may lack some packaged application that you need, so you may try to build it from scratch (the hard way) or adapt a similar package from another distribution (generally, the preferred way). Next, not all software is open source, so you may pack a binary-only application or even a set of random files and make them installable with a few clicks of your mouse. This is often needed to deliver some proprietary, yet popular, software items such as the Vivaldi browser or Skype VoIP application.

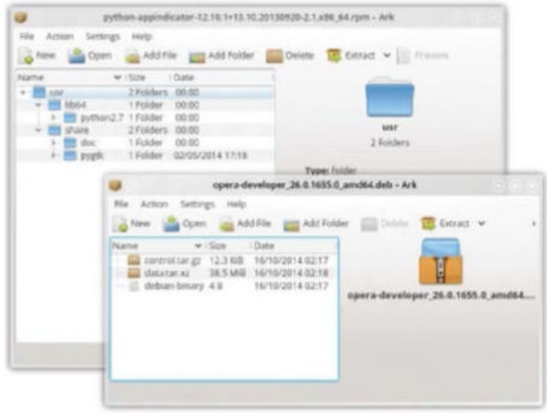
02 The inside of RPM

When you double-click an RPM file it will probably be opened in a software installing tool, but you can always open it as an ordinary archive. File Roller or Ark will open an RPM just the same way as they would open a ZIP archive. However, while you'll see the file tree, there's more to RPM as it includes scripts that enable extra actions with files, such as fixing permissions, copying and removing files, or any other custom action in Bash.

Whatever architecture an RPM file is designed for, be it x86_64, i586 or noarch, it is generated from a source RPM, also known as SRPM. It contains the sources of the application and a spec file, which defines all the commands and routines that you will need to compile it into the target RPM file. If you need to re-pack a proprietary application, sometimes only a properly written spec file is required, as it obtains the app files automatically.

03 Compile RPM from a source RPM

For the impatient, the command is simply: **rpmbuild --rebuild /tmp/mypackage-1.0.0-1.src.rpm**. Another way is to install the source package as follows:



Left Both DEB and RPM packages are easy to unpack and explore. You can always pull out their contents with standard archive managers too

```
rpm -i /tmp/mypackage-1.0.0-1.src.rpm
```

... and then address the spec file directly:

```
cd ~/rpmbuild/SPECS && rpmbuild -ba mypackage.spec
```

Take note that all commands should be issued under a regular user account and not root, due to security reasons.

To make things work, you'll need the rpm-build package and all development libraries and compilers required to build the sources of your application. If you're recompiling something that is already present in your system's repositories, you may try **zypper si -d mypackage** in OpenSUSE, **urpmi –buildrequires mypackage** in OpenMandriva/Mageia, or **yum-builddep mypackage** in Fedora.

The contents of the src.rpm file is unpacked into the rpmbuild directory in your home folder (~). The standard tree of an RPM packager resides here, and a full set of subdirectories: build, buildroot, rpms, source, specs, srpms.

Alien vs DEB/RPM

Alien is a tool that converts a Debian package into an RPM and vice versa. It works great for many niche and binary-only packages. To convert a DEB to RPM, issue the following:

```
alien -r -c /path/to/mypackage.deb
```

The reversed action is even simpler:

```
alien /path/to/mypackage.rpm
```

"Use checkinstall, not make install when you build an application or library from source"

Follow policies

Whether you build custom packages solely for your localhost or publish them in public repositories, the essential thing to do first is to study package building policies for your Linux distribution. For Ubuntu, Debian, Fedora, ROSA and OpenSUSE, these policies usually differ in details but agree in the main principle: writing specs or control files should be done accurately to make sure the ever-growing repositories maintain trouble-free performance.

04 Writing a dummy spec

The image on page 24 illustrates a simple dummy spec file, which can be compiled into an RPM containing two files: dummy.file and dummy.another.file. To make things work before you launch rpmbuild, put these files into the %{buildroot}/etc/dummy directory. During the build process rpmbuild may complain on some minor issues, which sum into the badness score. If the score surpasses a certain threshold then the build will fail. Of course it's best to fix problems rather than to override the score, but in case you need the latter choice, use the setBadness command in your spec. For example, to enable building a package that includes an unauthorised permissions file, add the following line:

```
setBadness('permissions-unauthorized-file', 0).
```

05 A simpler way: use checkinstall

Use **checkinstall** instead of **make install** when you build an application or a library from source. Checkinstall works in Debian and Red Hat, where it asks you for some details (package name, version, description, etc) and automatically produces a package. The main benefit is that you can keep your system clean and tidy. If you need to wipe off the files, simply remove the package with your standard package manager tool (urpme, zypper rm, yum remove). The downside of checkinstall is its limited features. For example, you can't include post-installation scripts with it and so it won't work when packaging some proprietary apps, as it needs extra hooks for many systems. However, checkinstall is perfect for local installations or small OEM tasks, so try it.

06 A brief look at handling the .deb format

Just like with RPM, DEB files can be opened with archive managers so that you can see the two other tarballs: data.tar.gz and control.tar.gz. They are pretty self-explanatory – the first one contains package files, the second one package metadata. Building DEB packages is different from RPM but still straightforward. It's even more standardised, as in Debian/Ubuntu and their clones there is one dominating technology to handle deb packages – apt plus dpkg. Apt is a powerful tool for handling packages and repositories and has various companions, like aptitude for flexible search queries, while dpkg is solely a package management tool (like the rpm command).

07 Build DEB packages

First, get the essentials:

```
sudo apt-get install autoconf automake libtool
autotools-dev dpkg-dev fakeroot dh-make
```

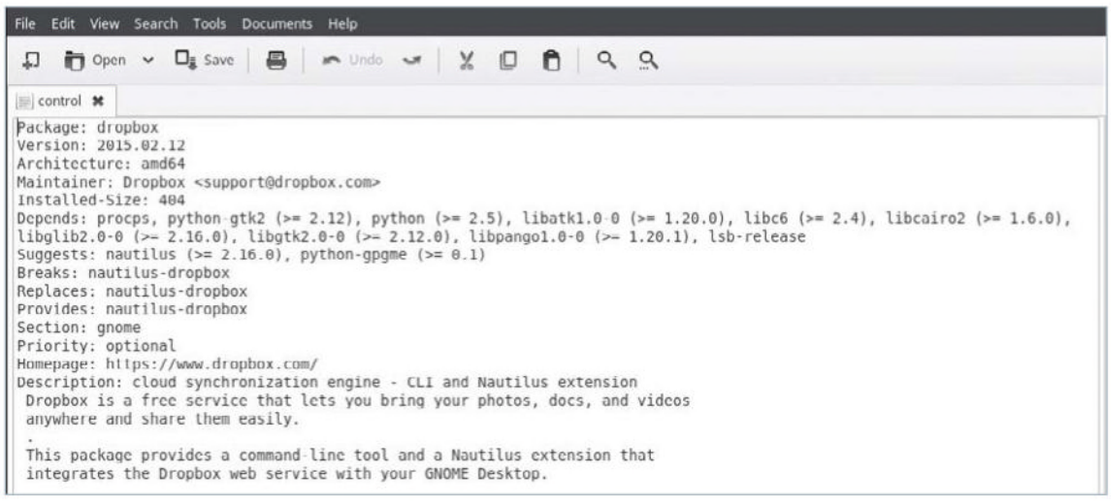
Imagine, for example, you've got mypackage-0.0.2.tar.gz, which you wish to compile into a DEB package. First, prepare a build directory manually like this:

```
mkdir -p ~/src/mypackage/0.0.2
```

Then put your tarball into that directory and unpack it (**tar xzf mypackage-0.0.2.tar.gz**). Then you will need to compile the program using classic commands:

```
./configure --prefix=/usr && make
```

If you're recompiling a program that already exists in one of your repositories, you can ease the development dependency resolution by issuing **apt-get build-dep mypackage** beforehand in order to make the ./configure script run more smoothly.



Right This sample debian/control file illustrates the required minimum versions of other packages it depends on



Left Debreate lets you escape the command line and create your DEB package with friendly step-by-step wizard

Package maintainers

There are various tools that aid creating and maintaining high-quality software packages. In the case of Ubuntu/Debian, the official policy says the synopsis line in debian/control must be concise, not repeating the package name, but also informative. It's also a good idea to write useful changelog entries to debian/changelog each time you update a package.

After building the updated version of the package you may want to find out the difference between new and old version. Use the debdiff command for that:

```
debdiff package_1-1_arch.deb package_2-1_arch.deb
```

Also keep in mind that both ispell and aspell have special modes for checking debian/control files:

```
ispell -d american -g debian/control
aspell -d en -D -c debian/control
```

In the RPM world, the most advanced helper tools have been introduced in ROSA and OpenMandriva, where the latest RPM5 technology is being used. Install the spec-helper package (**urpmi spec-helper**) to access extra tools: spec-cleaner and rediff_patch. The first is useful for adapting a spec file from different Linux distributions: it fixes Buildroot and Packager sections according to global variables, cleans the buildroot tree, fixes hard-coded '%{name}, %{version}' and '%{release}' variable values and does minor fixes. The syntax is simple:

```
spec-cleaner old.spec new.spec
```

Rediff_patch updates a patch file (.diff) to work with a new version of a source tarball. Place the old patch, spec file and a new tarball into a new directory and run:

```
rediff_patch <patch_ro_rediff> <tarball>
```

08 Debianise it

Run **dh_make --createorig**, answer a few questions about the package's details and finally hit Enter. You will see the newly created debian subdirectory added to the sources tree. Edit the debian/control file and modify the package description if necessary. Now, make sure you're currently in the main sources directory and issue the command:

```
dpkg-buildpackage -rfakeroot
```

After a while, once the building process is over, move a level up and enjoy your newly created DEB package. You can double-click it or use the **dpkg -I mypackage-0.0.2*.deb** command.

Notice the .dsc file, which can help you pull the application sources in future. The syntax looks like this:

```
dpkg-source -x ./mypackage-0.0.2.dsc
```

09 The graphical way

Debreate is graphical tool and step-by-step wizard for those who want to avoid the command line fu. You can download and install Debreate from its official mirror (**bit.ly/1ItNSPQ**) – it is a universal .deb package itself and suitable for nearly all systems.

On the Control tab you are supposed to fill in the info and description fields, much like you would do if you were in the debian/control file.

The Dependencies and Conflicts tab enables you to specify package requirements or conflicts, including specific minimum versions. After that, select the package contents on the Files tab, include optional post-installation commands on the Script tab, create a desktop menu entry on the Menu tab and finally press the big green button on the Build tab to generate the DEB package. With this tool, it should be both faster and easier to create a Debian package.

APPS

Choose the best software for your system

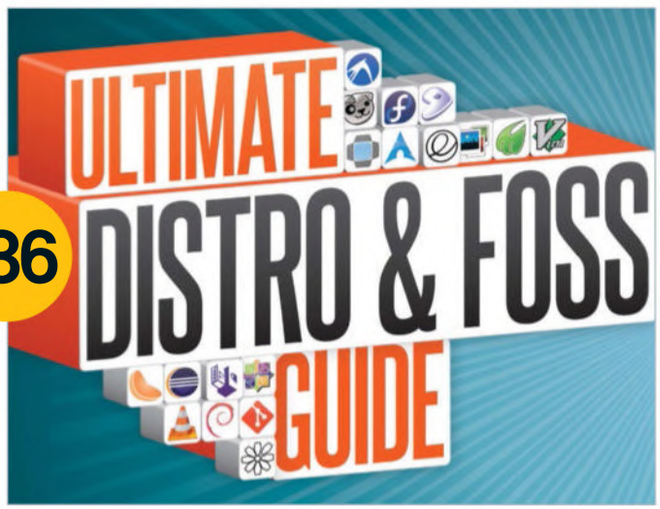
136 **Ultimate distro & FOSS guide**
The best free software for all uses

146 **Tails 1.3**
The Tails team tightens security for 1.3

147 **Ubuntu 15.04 Final Beta**
Ubuntu makes the switch to systemd

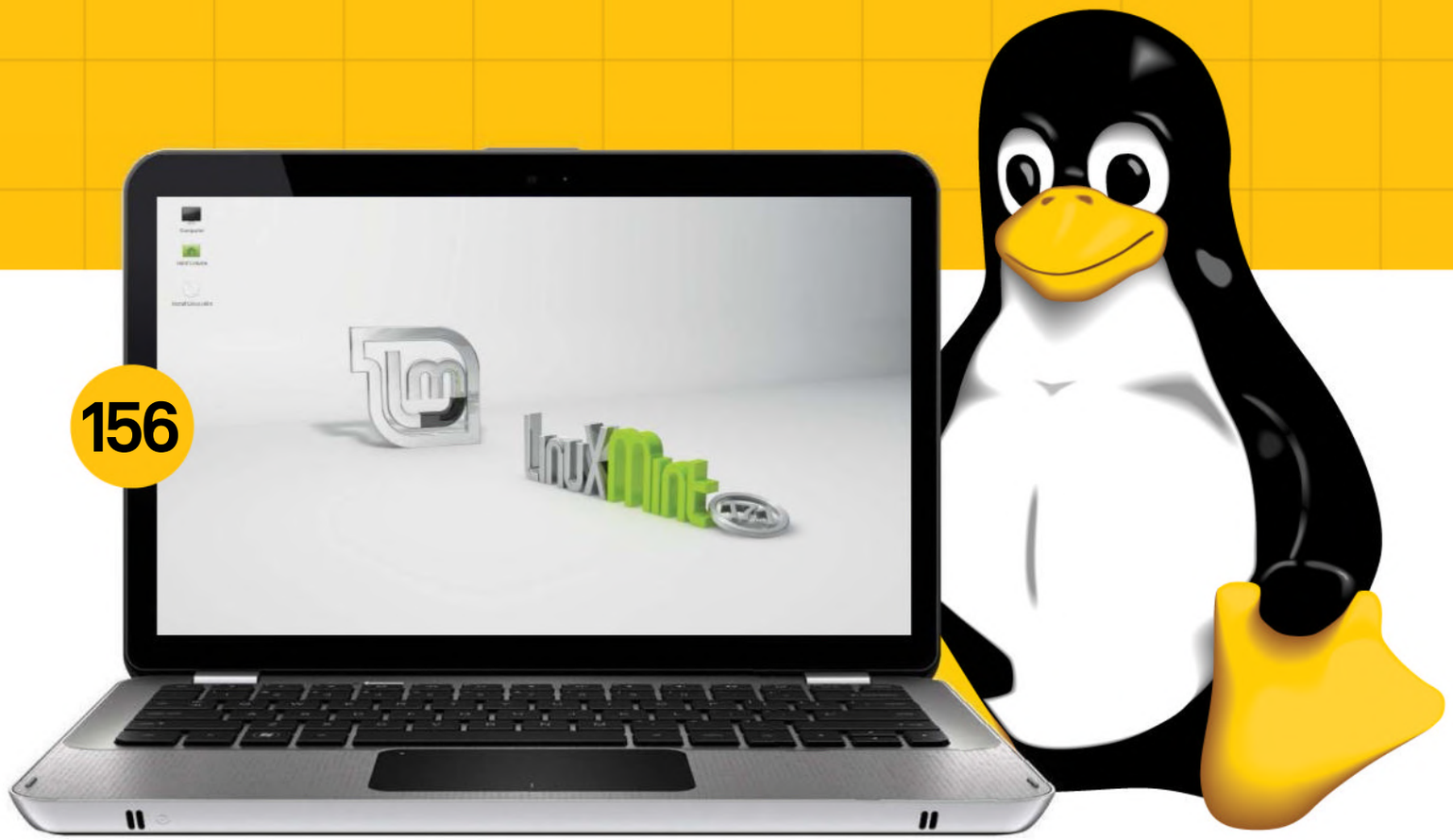
148 **Debian 8.0 Jessie**
The new LTS release for Debian

"An everyday distro is quite broad: the kind of operating system you can use for anything and everything and is easy to use"









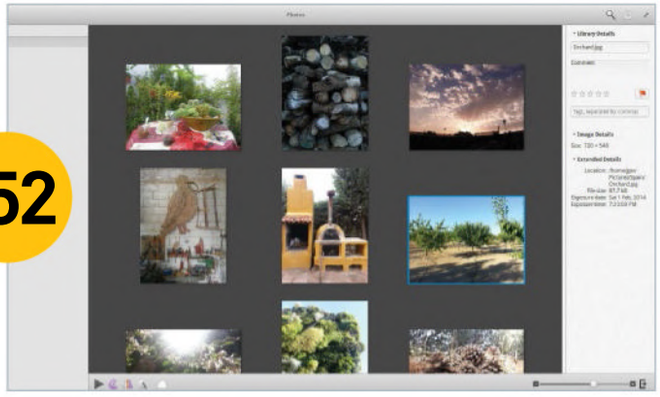
150 **Fedora 22**
How did Fedora build on 21's foundations?

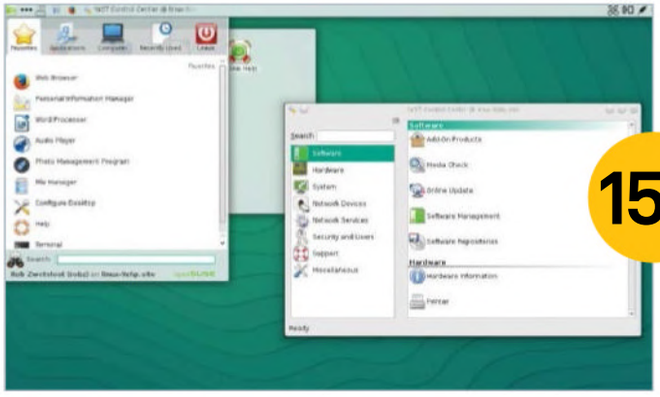
152 **elementary OS 0.3 Freya**
An update with over 1,1000 improvements

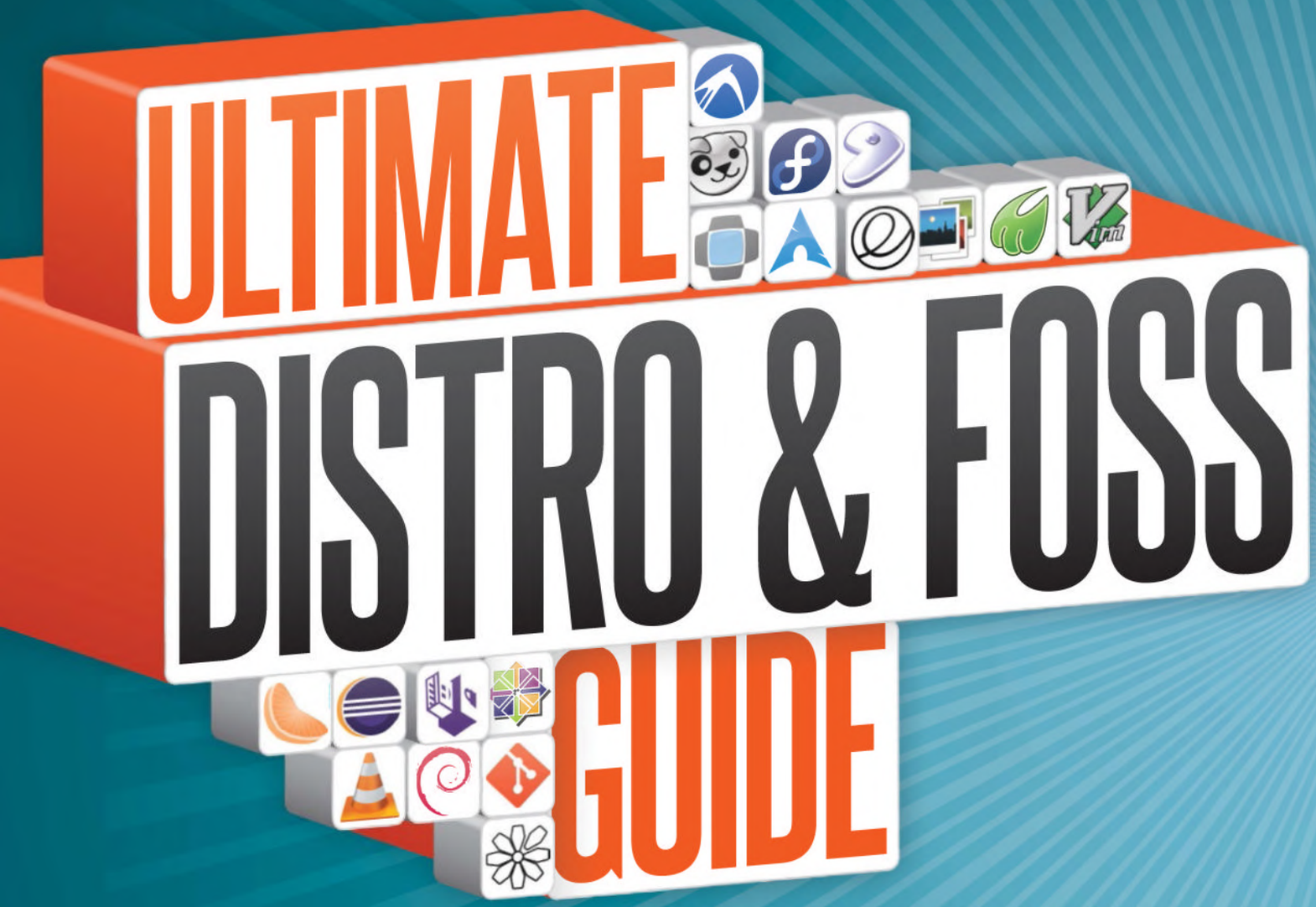
154 **openSUSE 13.2**
The next step for all Linux users

156 **Linux Mint 17.1**
Mint's first truly independent desktop









ULTIMATE DISTRO & FOSS GUIDE

Discover the best free software in every category and see which ones you should be using

BEST DISTRO FOR...

Everyday

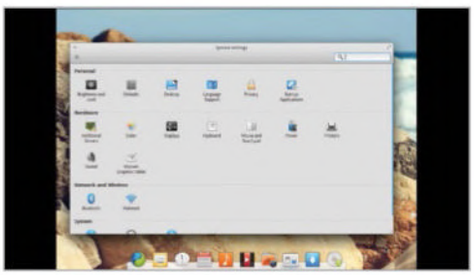
Is this the year of Linux? Or is it the year we stop claiming that? Either way, there are already plenty of choices for your day-to-day

Elementary OS

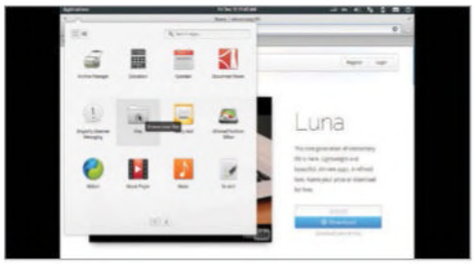
An everyday distro is quite a broad thing; in this context we mean the kind of operating system you can use for just about anything and everything without really specialising in one specific area. Something that's easy to use and its supplied tools aid your use of it.

This is exactly the point where elementaryOS comes in. Aiming to be easy to use for people of all skill levels, elementaryOS is a beautifully designed distro that has had a lot of care put into it. Using an Ubuntu LTS as a base and cribbing from a lot of existing design decisions, elementaryOS is hardly a completely original Linux distribution.

What makes elementaryOS unique is its use of these design aspects and design decisions, putting together a wholly new desktop and distro experience



Elements like the dock and window styling will look familiar



The simple, searchable applications menu takes design cues from mobile operating systems

that you can't find anywhere else without some serious customisations on the user's part. It's the best of every world for people who prefer using a fully-feature graphical desktop, and it works extremely well on new and modern systems.

The wording on the website is inclusive and friendly to newcomers as well – not once is there mention of Linux or distribution, instead using wording familiar to everyone and rightfully referring to elementaryOS as a whole as an operating system. This kind of friendliness and familiarity is translated to the desktop, from a simple dock bar that grants access to important programs from the moment you start using it to an applications menu reminiscent of modern smartphone design.

The stable Ubuntu base also grants access to an unprecedented level of packages and other desktop types if you want something a little different to elementary's offering. It's a great first distro for people who want to make the switch to Linux as well.

ALTERNATIVE DISTROS

Linux Mint

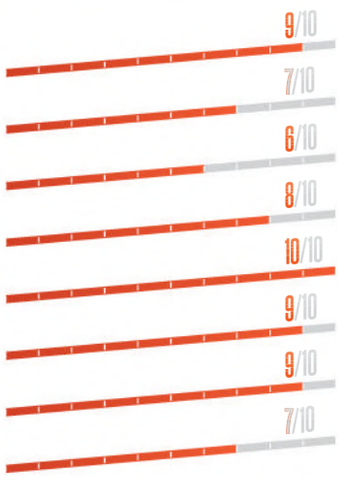
Another firm favourite as an everyday distro, Linux Mint would have taken this category by storm once upon a time due to excellent design over two fantastic desktops on top of an excellent distro.

Ubuntu

Ubuntu is probably the most popular distro in the world, or at least the most well-known, which means a lot of software supports it and not other distros. You can customise it anyway you want off of its core base.

Mageia

Mageia is a very user-friendly spin on the Mandriva family with some excellent apps for controlling just about every aspect of the distro along with other smart design choices. It's been brought back into Mandriva but is still great.



BEST FOSS

LibreOffice

The office suite that has far superseded its originator, LibreOffice can handle all your word processing, spreadsheeting and presentation needs extremely well with a selection of excellent software.

Firefox

Once again the king of the browsers, with half a billion users around the world, Firefox has privacy and customisability in mind with its design. Due to some excellent cross-platform tools, you can use it wherever you want.

Thunderbird

The email counterpart to Firefox has remained a very strong email client on any operating system for a long time. With a great range of add-ons and extensions, you can have it work exactly as you'd want it to.

Cinnamon

The desktop environment originally made for Linux Mint, Cinnamon uses a more traditional desktop layout and a lot of common sense design choices and workflow methods that make the most of modern tech and traditional ideas. It's an improvement on many default desktops.

Shotwell

Excellent photo management software used by a lot of distros by default, it even has some basic support for RAWs. You can perform batch operations to tweak colours and lighting, or just organise photos into specific tags.

BEST DISTRO FOR...

Lightweight

A lighter Linux distro can help you get the most out of an older or underpowered system by using relatively fewer resources

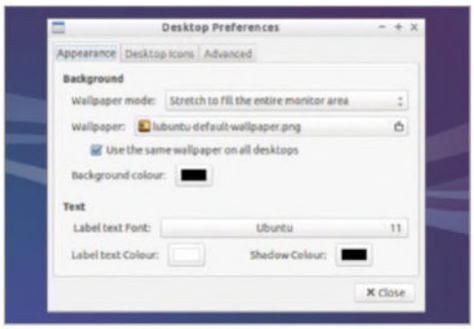
Lubuntu

You can define lightweight in a number of ways these days. While the graphical software part of a distro itself can be the one that is most resource intensive, the core kernel and behind-the-scenes packages can also take power away from CPU cycles. While Lubuntu and other normal Linux distros running LXDE don't do much to the core of their operation, merely running the desktop itself can be a huge relief on some systems.

That's why we're awarding Lubuntu this prestigious prize. While we're not the biggest fans of Unity, the distribution underneath the desktop environment is an incredibly solid and relatively easy-to-use system that a good desktop environment can really make the most of. LXDE is not only extremely light – it uses 78 MB of RAM compared to XFCEs 89 MB – it's also (very importantly) as fully-featured as most modern desktops. Add this to Ubuntu's impressive software and packages and you've got a lightweight distro that doesn't sacrifice any usability and still has access to all your favourite software.



Lubuntu has an excellent Software Centre to make package downloads easier



While minimal, the LXDE desktop styling is very smart

As for lightweight software, Lubuntu comes with quite a different selection of default apps compared to its vanilla counterpart. A smattering of the basics such as Firefox, Pidgin and Abiword are all you're presented with. It's enough to get you started and thanks to access to the full Ubuntu repos you can then start building up your system with some of the excellent and lightweight apps that Linux is known for.

It's definitely not the lightest distro around but it's certainly the best distro that comes under the lightweight banner.

ALTERNATIVE DISTROS

wattOS

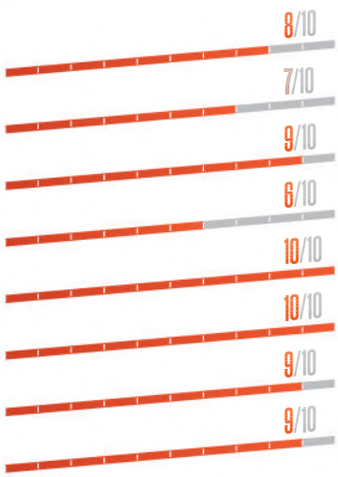
A very lightweight and speedy operating system that aims to do two things: boot to desktop very fast and also save you electricity, either plugged in or on the battery. It does both of these exceedingly well.

Puppy Linux

Puppy Linux lets you teach an old dog new tricks – it's specifically designed for older systems and is extremely resource friendly. It can live in a very small amount of RAM yet still includes a very functional system.

Porteus

A very fast live distro that takes up only 300 MB of space, and is optimised to run from live media as well. You can add modules for extra software if needed, making it a very customisable distro.



BEST FOSS

Audacious

Very lightweight and very fast, Audacious is the definitely the best audio player for those on a resource budget. It hooks into notification centres of most major desktops as well, allowing you to control it better.

Midori

Midori teeters on the edge of being just a bit too lightweight to be as useful as some of its peers, but it managed to maintain a number of excellent features to make browsing the Internet with it acceptable in 2015.

CMPlayer

A lightweight video player that still has a fairly decent interface and no need for mucking around in the command line, it will play all the media you need as long as you have the right codecs and backends installed.

Geany

A text editor with IDE features that is popular among those with a few small projects on the go. It's easy enough to switch between the two types, meaning you can use it for your day-to-day text editing before going full developer.

Enlightenment

A window manager or full desktop environment, Enlightenment is an incredible flexible and lightweight framework loved by hardcore users. It's rarely used as a default desktop, but give it a go if you're on the hunt for something different.

BEST DISTRO FOR...

Entertainment

Here are your best distros for making custom systems to play all your media, either on a TV or just for better navigation while at your desk

OpenELEC



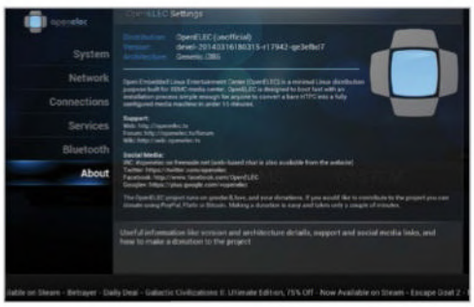
When it comes to media and other forms of entertainment consumption via computers, one of the most recognisable names in existence is XBMC. Very likely because of its quite redundant legacy naming, it's unfortunately dropping the well-known branding in favour of new name Kodi. What's this all got to do with entertainment distros though?

Well the devs behind Kodi also make the excellent OpenELEC, a Linux distro optimised for a number of different hardware types to offer the best possible Kodi experience.

Not only does it work on specialist hardware such as the Raspberry Pi, Apple TV and some other hardware ideal as HTPCs, but you can also get generic PC builds for x86 and x64 systems.OpenELEC takes up only a tiny amount of your file system while still offering a full version of Kodi. This means you can use any remaining storage to keep media local, such as your party playlist, if that's your kind of thing, however you can still stream your media from any other computer set up to share it. Setting up these shared folders in Kodi is a quick and simple exercise, and it even scrapes together information on the files to make navigation easier.

There are also plenty of add-ons available that allow you to stream media for many online video sources, as well as recently-added native Live TV viewing and recording – the latter being a better use for your hard drive space.

For both TV and PC, this is an excellent way to consume media in almost any situation, with plenty of codecs and online features.



OpenELEC claims to set up your media box in 15 minutes



There are some customisations you can make, as well as add-ons to install

ALTERNATIVE DISTROS

GeeXbox



A direct alternative to OpenELEC that gives you a little more choice for how you set up a HTPC. It hasn't had any new development for about a year now, but that's nothing to worry about as it's still excellent.

Ubuntu

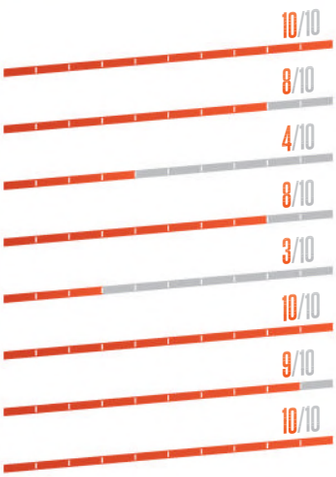


When it comes to being an entertainment distro, Ubuntu's strength is its supreme list of packages. You can set up XBMC/Kodi, Plex, Myth or just plain video and music players on Ubuntu of any type.

AVLinux



Not for playing back your media per se, AV Linux is an excellent way for you to actually create audio and video yourself, thanks to a custom kernel and great package selection on a live CD or live USB stick.



BEST FOSS

Kodi



Previously XBMC, Kodi Entertainment Center is the premier media PC software around. It's the software behind OpenELEC and it can be used for simple music and video playback, or streaming services and recording live TV.

VLC



An extremely powerful yet small piece of software that can not only play just about any form of media, but also send, receive and record network streams. It's very customisable and easy to use even if you don't want to stream your desktop.

Clementine



The most fully-featured audio player around, with incredible library and playlist management and an excellent interface to boot. It also has a smart playlist that will build itself on the fly, however it doesn't run well on older systems.

Nuvola



One of the problems we have found with browser-based streaming is that we cannot control playback with media keys or hotkeys. Nuvola allows you to keep all your streaming audio in one place and, more importantly, control it.

GIMP



The powerful image manipulator that is probably the best open source has to offer, GIMP can even challenge Photoshop thanks to its array of excellent features and tools – it even has a more straightforward naming convention in places.

BEST DISTRO FOR...

Development

With Linux proving a popular platform for development work, which is the best of the bunch for getting your code on?

Arch Linux

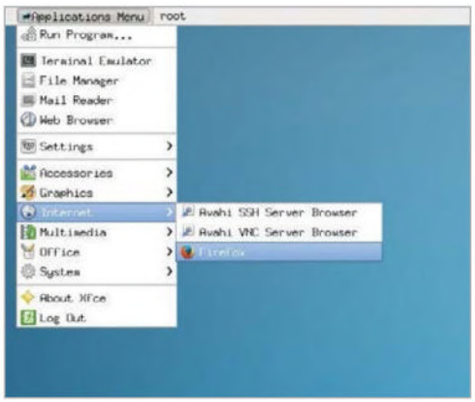
Arch has never been a distribution to pander to the common denominator. While its contemporaries add user-friendly wizards and hand-holding installation packages, Arch dumps the newcomer to a console session and leaves them adrift with little more than a Wiki page for company. For beginners, simply getting Arch installed can seem like a major achievement – but beginners are most certainly not Arch's target market.

Once it's installed, Arch reveals its true potential. It allows the more technical user to install only the packages required for day-to-day work for guaranteed zero bloat, with all the benefits to performance, stability and your ability to concentrate that this implies. Tweaking your Arch install can become obsessive, but once it's set up to your liking you can expect a smooth ride.

Arch is certainly not a distribution for beginners, but those with Linux experience will find plenty to like about it. It has an active community, albeit one which can be unwelcoming to beginners, boasts a great package selection for even some of the more esoteric tools in a developer's arsenal, and promises to provide an easily-customised environment tailored specifically to your individual needs.

A rolling-release development methodology means that while installation may be painful it's a one-off experience, and users are guaranteed to be working on the latest available tools and resources. There's a good reason Arch and its derivatives are popular among Linux kernel developers as well as those who write software for other platforms.

Finally, Arch has an ace up its sleeve for those targeting Arch itself with their creations: the Arch Build System. Designed specifically for Linux developers, the ABS offers the ability to create, customise and distribute packages into Arch which are built directly from source. Based heavily on the BSD ports system, ABS offers automation for tasks other distributions require developers to perform by hand.



You can install just the tools you need for zero bloat

ALTERNATIVE DISTROS

CrunchBang

A Debian derivative, CrunchBang uses the lightweight Openbox window manager to be as distraction-free as possible and offers a good balance between the performance and flexibility of Arch and the shallow learning curve of Ubuntu.

Gentoo

Like Arch, Gentoo features a BSD ports-like package management system dubbed Portage, and a release system ensuring users install the latest packages compiled from source with per-distro optimisations.

Ubuntu

Often derided for Canonical's treatment of the wider open-source community, Ubuntu nevertheless promises wide compatibility backed by the option of commercial support contracts.



BEST FOSS

Eclipse

It might lack compatibility with the GNU General Public Licence, but the Eclipse Public Licensed Eclipse IDE is a powerful tool. Based on IBM's Visual Age, it supports most common programming languages you'll be working with.

VirtualBox

While the GPL-licensed VirtualBox OSE build only provides virtualised USB 1.1 support, its other features make it a great way to run alternative operating systems on top of userspace Linux; ideal for testing your code on other platforms.

Git

Born of a copyright confusion that surrounded BitKeeper, Git is the distributed revision control system of choice for kernel developers. It allows for easy collaborative working with plenty of ways to track bugs added in later code revisions.

Vim/EMACS

Did you really think we were going to get involved in this debate? A good text editor is the programmer's best tool, but we're staying on the fence with this one. Whether you're an acolyte of Stallman and Steele or a proselyte for Moolenaar, use whichever of these works for you.

GNU Debugger

The standard debugger for GNU/Linux, GDB's capabilities extend beyond the obvious with support for programming languages ranging from Free Pascal and Ada through to Objective-C and Java. We recommend giving it a try.

BEST DISTRO FOR...

Enterprise

For companies, Linux can significantly reduce the total cost of IT infrastructure, but which distribution stands out?

SUSE Linux Enterprise Desktop/Server

When it comes to desktop Linux distributions for the enterprise crowd, there are two names that go toe-to-toe: SUSE and Red Hat. Both offer distributions for the desktop and server specifically marketed as 'Enterprise Linux', and both back up their offerings with a wealth of commercial support.

With customers as varied as the London Stock Exchange and Office Depot, SUSE Linux Enterprise is extremely popular. Features like SUSE Manager, which provides automation of server management, and SUSE Cloud, providing OpenStack-powered local cloud infrastructure, make it easy to see why.

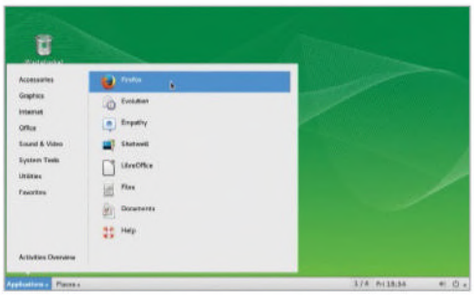
Enterprise users typically need support, which is – naturally – where SUSE makes its money. As well as direct commercial support, the company offers various consultancy services including SUSE Assist. SUSE Assist, the jewel in SUSE's support crown, offers on-site services from a certified professional for companies that can't afford to have a specialist on their staff.

As well as its Desktop and Server variants, SUSE Linux Enterprise comes with the option of add-on extensions, including those that make it suitable for use in point-of-sale environments and high-availability extensions where required along with real-time and thin-client variants.

Stability and support do come at cost to flexibility, however: compared to the community-driven OpenSUSE, SUSE Linux Enterprise has fewer packages available by default, removing many of the packages that aren't well-suited to a more professional environment.

The final tick in the box for SUSE is its SUSE Studio platform, which provides a means for users – Enterprise or otherwise – to customise Linux distributions and create everything from Live CD images to VirtualBox images and even Amazon Elastic Compute Cloud (EC2) instances tailored to their needs.

While SUSE is our pick at present, it continually trades places with Red Hat as the two attempt to out-do each other; before committing to one, be sure to check out what the other's offering too.



SUSE is a highly curated distro, tailored to its needs

ALTERNATIVE DISTROS

Red Hat Enterprise

Like SUSE, Red Hat offers its Enterprise Linux variant in server, desktop and specialist variants, and boasts a healthy client list including ETH Zurich. Support is plentiful, and the company operates training facilities throughout the world.

OpenSUSE

OpenSUSE is the community-driven, fully-open variant of SUSE Linux. Sponsored by SUSE, OpenSUSE requires no support contracts or licensing and often provides newer features.

Ubuntu

Like SUSE and Red Hat, the company behind the software – Canonical – offers varying support contracts and training options, while its software compatibility is top-notch.



BEST FOSS

Puppet

An open-source configuration management utility designed to support heterogeneous networks of Unix-like and Windows machines, Puppet is a powerful automation tool for sysadmins of Enterprise-class infrastructures. Worth a look!

Chef

An alternative to Puppet, the Ruby- and Erlang-based Chef integrates well with commercial cloud environments including Amazon's EC2 and Google's Cloud Platform, and works as a local install for managing internal infrastructure.

Docker

Docker provides the ability to easily and quickly deploy applications inside isolated software containers on Linux. Compared to a traditional virtual machine, a Docker container has significantly lower overheads.

Lynis

Designed for those who take a proactive approach to security – but, it has to be said, a handy tool for the black-hat crowd as well – Lynis provides a means to audit Linux and other Unix-like systems for security vulnerabilities, and can also check for configuration errors.

SUSE Studio

While SUSE Studio is most commonly used by the SUSE and OpenSUSE teams, its ability to customise and deploy operating system images can be used with any Linux distribution and can make a system administrator's job significantly easier.

BEST DISTRO FOR...

Security

While the mainstream media worries its readers over black-hats, security-focused distributions are a vital tool for the good guys

Kali Linux

For years, BackTrack Linux was the king of Linux distributions for those doing security audits and penetration testing. In 2013, however, the project was forked into Kali Linux. Created and maintained by Mati Aharoni and Devon Kearns of Offensive Security, Kali is a ground-up rewrite of BackTrack and a worthy successor to it.

Based on Debian, rather than the Ubuntu origins of its predecessor, Kali includes pre-installed copies of the most popular security utilities, including network sniffer and analyser Wireshark, port-scanning tool nmap, password cracker John the Ripper and even the Aircrack-ng suite for penetration testing of wireless networks. Its repositories have plenty more choices available, in addition to more sedate applications and utilities.

Where Kali differentiates itself from the competition is in compatibility: as well as 32-bit and 64-bit x86 hosts, the team behind it have worked hard to bring Kali to the more popular ARM-based platforms out there. Builds are already available for devices as diverse as the Raspberry Pi and Samsung Chromebook, with more builds arriving on a regular basis. Considering the very low cost of some of these devices, Kali's support helps lower the barrier to entry considerably over distributions which require more expensive hardware to run.

Perhaps the most impressive compatibility feature, however, is a Kali sub-project dubbed NetHunter. Currently available exclusively for Google's Nexus Android smartphones and tablets, Kali NetHunter provides various wireless penetration testing tools usable directly from the device – a great tool for discreet testing without having to lug an all-too-obvious laptop around.

Combined with options to install to a hard drive as well as run from memory and an attractive desktop which lends itself well to every-day use, Kali is the obvious choice for anyone with an interest in network security – despite its reputation as a script-kiddie's play-thing, it's actually pretty tight on the security front.



Kali has everything you need for full security testing

ALTERNATIVE DISTROS

BackBox Linux

For those who don't need ARM support, the x86-only BackBox is a great alternative. Based on Ubuntu and featuring the lightweight Xfce window manager, BackBox is powerful yet attractive and comes with a selection of pre-installed utilities.

Wifislax

For penetration testing of both wired and wireless networks, the Slackware-based Wifislax is brilliant thanks to integration of many unofficial hardware drivers and firmwares not normally part of the mainline kernel.

REMnux

REMnux specialises in reverse-engineering of malicious software. Tools are provided for memory investigation and analysis of various executable formats as well as documents and even web content.

6/10
7/10
5/10
5/10
9/10
9/10
6/10
9/10

BEST FOSS

Lynis

Created by Michael Boelen, the author of Rootkit Hunter (rkhunter), Lynis is a fully open security audit tool. As well as checking for vulnerabilities, Lynis has the ability to find misconfigurations with reports that can prove to be extremely useful when hardening a system.

nmap

A tool so famous it ended up with screen time in *The Matrix Reloaded*, Fyodor Vaskovich's (real name Gordon Lyon) nmap should have a place on every system. Its rapid network mapping is incredibly flexible and can be individually tailored.

OpenVAS

The Open Vulnerability Assessment System (OpenVAS) started life as a fork of Nessus under the name GNessUs. Now, it's one of the leading vulnerability scanning and management tools – and it's entirely free and open-source.

Wireshark

While Wireshark – formerly Ethereal – has its competitors in the packet-sniffing arena, its friendly user interface and powerful analysis and filtering tools are second to none. Wireshark is useful for general network diagnosis as well.

Metasploit

This framework is invaluable for penetration testers. When a scan has revealed a vulnerability, Metasploit can attempt to exploit said vulnerability; proving or disproving its existence quickly and easily.

BEST DISTRO FOR...

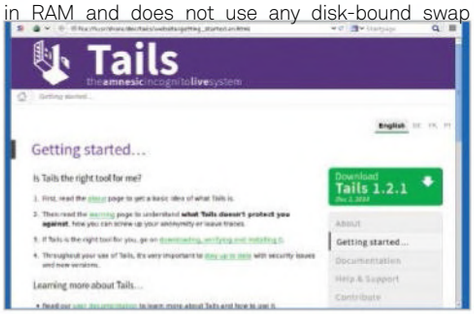
Privacy

Stay private and keep your information safe with these Linux distros specially built to put your mind at ease when working online

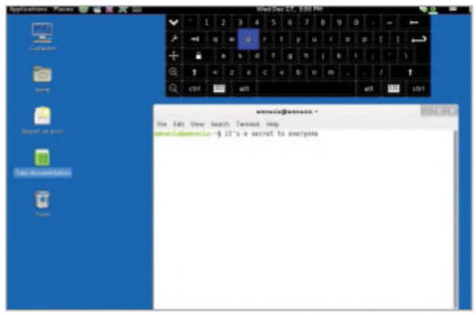
Tails

Privacy can be extremely important on the Internet, and it's only going to become more of a concern as time goes on. With more ways to leave your trace on the Internet, and more companies wanting your details to sell you ads, it can be tricky to remain truly anonymous. This can be essential for some people – whistleblowers, victims of stalking and people writing unpopular opinions on Twitter. It can also be handy for just buying a secret gift for your other half to avoid the inevitable targeted ads popping up that an incognito mode won't stop.

Tails can help you with all of this, and makes it fairly easy to do in the process. It manages this through many careful layers of security and privacy considerations – firstly, the entire system runs in RAM and does not use any disk-bound swap partition. The RAM is then completely written over when Tails is shut down, leaving no trace of what you were doing or using.



Run Tails from a disc or memory stick to get the best use



All traces of user activity are removed as part of the shutdown process

All of its networking is run through Tor, so your IP is masked behind at least a dozen encrypted servers. Failing that, the default is the Tor browser, which also has the same software, meaning that whatever you're looking for, it won't get traced back to you. You can also use secure chat clients to keep your location safe, there's PGP email support built-in so you can send private mail and there's also just a full suite of normal programs like LibreOffice and GIMP, so you can use the distro in any other way.

You can install Tails, but it's designed to be live booted and that will guarantee maximum privacy at the same time. Give it a go today to find out just how easy it is to remain anonymous.

ALTERNATIVE DISTROS

ipredia OS

An alternative to Tails that relies more on the I2P network than Tor, yet still provides an environment where you can stay completely anonymous. It's also live, so you can test it out before committing to it.

Whonix

A very different private distro, anonymously connecting you online via an anonymous terminal and anonymous server, giving two levels of security to maximise privacy and stop any incoming attacks.

Liberte

A Gentoo-based Tails alternative that's not had much development recently but is still extremely private and very secure. It uses Tor and other software to keep the user safe from prying eyes.



BEST FOSS

Tor

In the movie *Sneakers*, an intrepid group of Bay Area hackers bounce their signal off multiple servers and satellites to avoid detection. Tor is essentially this, sending your requests through several secure and encrypted servers.

Tor browser

Built using Firefox and Tor, using the Tor browser is an easy way to stay completely anonymous online without the need for booting into a private distro. It's so good its used by default in Tails to make sure you stay private.

ClawsMail

This is a PGP encryption for your email clients, including Thunderbird, that lets you send messages in confidence. It also works on its own, just in case you want to leave even less trace of its existence on your system.

KeePassX

Manage your passwords with KeePassX, the cross-platform password manager. It allows you to store a lot of data in a highly encrypted database that can only be accessed via your password – once it's accessed, you can even search it.

Florence Virtual Keyboard

A virtual keyboard that avoids any keylogging programs to make your computer just that little more secure. It can also be used if your keyboard is missing and broken, and is extensible and customisable.

BEST DISTRO FOR...

Rolling release

For those who don't like to be beholden to formal release schedules, rolling-release distributions promise to never get out of date

Gentoo



Named for the speedy Gentoo penguin, Gentoo and Arch have long been rivals. Both offer a true rolling-release development methodology, meaning that the latest updates are brought to the entire user base simultaneously – ensuring that no installation is ever out of date, and that installation need only occur once – and both feature a BSD-inspired ports-like software distribution platform.

For the Linux purist, the hands-off approach of Arch is likely to appeal, but for the average user Gentoo is a gentler introduction to the world of rolling releases. First released back in 2002, the distribution has a considerable fan base who appreciate the team's still-rare approach to development and software releases.

The other main advantage to running Gentoo is that its software is compiled from source directly on the user's system via the Portage manager. This means no waiting for package maintainers to build and upload a package for your platform, and that the software which gets installed can be optimised for your specific processor architecture – enabling performance boosts where generic compilation would drain power from the system. The trade-off, of course, is that compiling from source typically takes longer than simply installing pre-compiled binaries from a package archive.

Like Arch, Gentoo's installation process has been tricky – although plenty of community help is available in documentation, IRC channels and mailing lists – but the relatively recent release of a Live USB variant makes it far easier to try. While its popularity has waned in recent years, Gentoo remains a great choice for anyone who wants a highly customisable system, and while it can be tricky to install it's a process that – in theory – should only ever have to happen once.



Support forums and an IRC channel are linked right from the desktop



Installation is slower but gives you better-optimised apps

ALTERNATIVE DISTROS

Sabayon



A Gentoo variant, Sabayon retains the rolling-release ethos but is a lot more welcoming. Designed to work out-the-box, Sabayon loses a little in flexibility compared to its upstream parent but is still a powerful distribution.

Arch



Arch can be unwelcoming to newcomers; first boot drops the user at a console session and installation is a process of following the instructions on the wiki. Once installed, though, it's lean, fast and extremely flexible.

Aptosid



Aptosid offers a familiar environment and rolling-release development. Taking Debian's unstable branch as its parent, Aptosid includes a custom kernel and retains compatibility with Debian's Free Software guidelines.



BEST FOSS

GIMP



The open-source answer to PhotoShop, the GNU Image Manipulation Program has recently introduced a single-window mode to combat criticisms of its unfriendly userface, bringing its power to a new audience.

Audacity



Supporting multi-track mixing and with more filters and utilities than you could imagine using, Audacity helps prove that Linux is no slouch when it comes to creative work and that it can hold its head up there with the proprietary platforms.

Firefox



Although under fire for perceived bloat – ironic, considering the project was founded to deal with perceived bloat in the Netscape browser – the Firefox browser, now on version 34, remains a popular choice among users.

LibreOffice



Created following Sun Microsystems' acquisition of OpenOffice.org, The Document Foundation's LibreOffice is now the default in many distributions, offering features and compatibility to please even the biggest Microsoft Office fan.

VLC



The strength of VLC lies in its flexibility. As well as the ability to play almost any audio or video format, it supports streaming over the network and the ability to record from various sources – including capturing a live view of your desktop.

BEST DISTRO FOR...

Live distro

The best live Linux distros you can boot up from portable media without installation

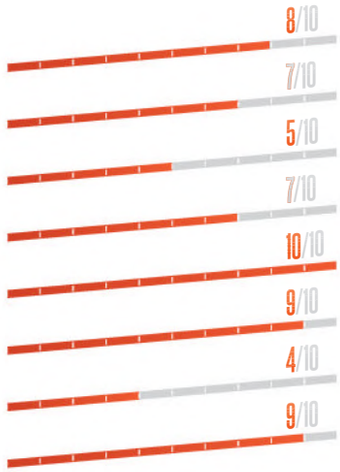
Knoppix



Knoppix is still one of the premier live distros, although competition has become fierce with other distros popping up that add something different to the mix. Knoppix has remained popular thanks to some core design choices, while updating in other areas to keep with the times.

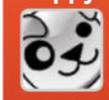
Knoppix positions itself as a showcase of everything that open source has to offer, and depending on what version of the distro you get, this can translate to having access to just about every known FOSS available on Linux without the need to install them – it has everything and the kitchen sink.

For having quite a lot of software, Knoppix boots and runs fairly fast. This is due to the way all the software is compressed and decompressed 'on the fly', allowing for 2 GB of the usual DVD to contain up to 9 GB of software that can be used at any time. Knoppix also has several custom boot options on a cheat sheet that will let you boot with different sound or display options, and even boot into the special ADRIANE interface for those who are visually impaired. Knoppix can be very handy to have installed onto a DVD or USB storage if you're regularly needing to quickly boot into Linux for some reason on various computers. It's not the best for sysadmin work, but it can do many other Linux-only computing tasks.



ALTERNATIVE DISTROS

Puppy Linux



A very special and tiny distribution that, while very light for normal computers, is best suited for giving ancient PCs some usefulness. It's based on Ubuntu usually, with a quite custom kernel and a different set of packages.

WebConverger



WebConverger allows you to set up a dedicated web kiosk for something like an Internet cafe, running a modified version of Firefox.

Porteus

A very fast live distro that takes up only 300 MB of space, and is optimised to run from live media. You can add modules for extra software if needed.

BEST FOSS

Clonezilla



The best way to clone your hard drive, Clonezilla supports full hard drives as well as partitions and can then be used to restore disk images in the future. It can be used on its own but it's best to use the live version.

GParted



Format, edit, resize and basically do anything you want with your hard drive and partitions using GParted. It's included on most live CDs because it's excellent at doing this task and is also easy to use.

Wicd

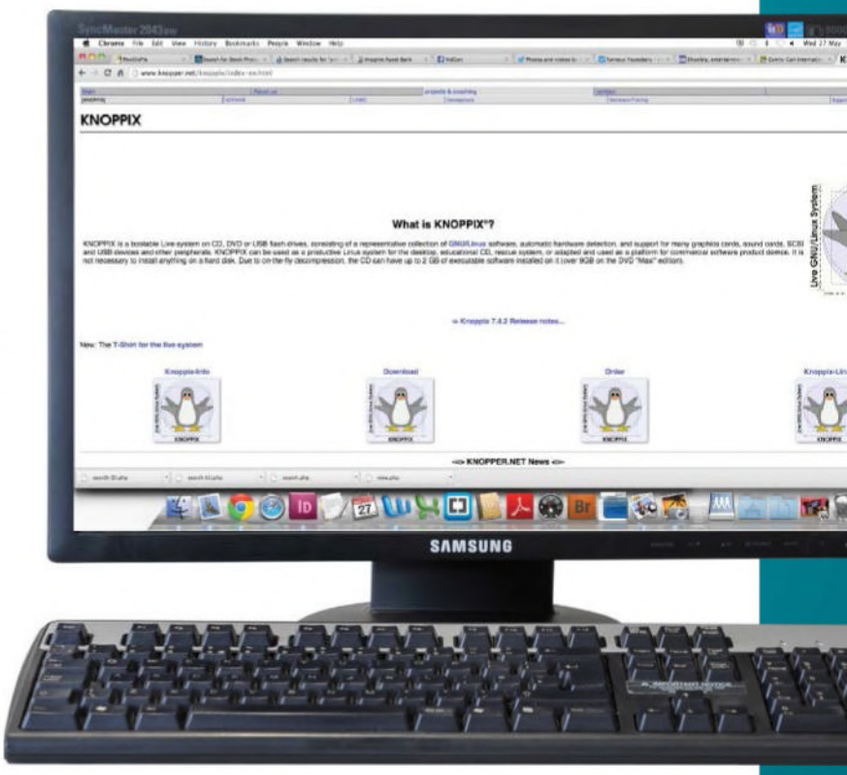


An excellent and easy to use networking utility that can be used for both wireless and wired, it makes connecting to and managing networks easy, in the past we've had it win our network manager group test.

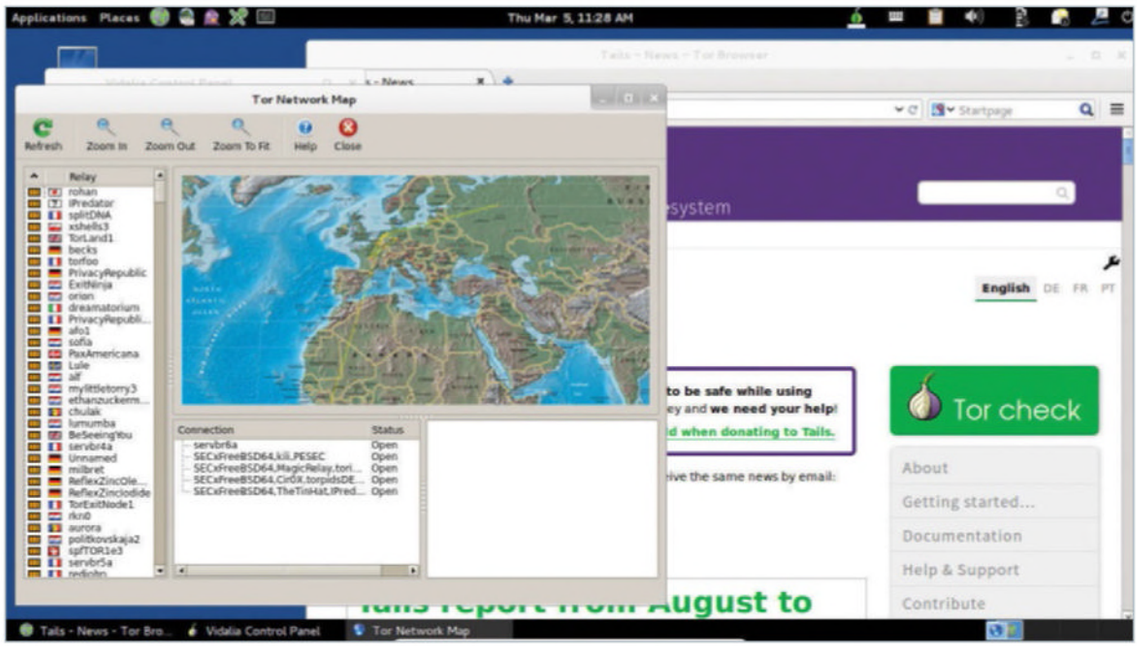
TestDisk



If your backups have failed or something else has gone horribly wrong, TestDisk can recover your data from a hard drive. It supports all major file system types and works from the terminal.



You can download Knoppix from www.knopper.net/knoppix



Left Keep track of your connections while you browse privately

Tails 1.3

Privacy is made better as the Tails team works to improve and upgrade its eponymous secure distribution

CPU
x86 compatible (IBM PC compatible and others, but not PowerPC or ARM)

RAM
1 GB recommended

Storage
Internal or external DVD reader, or ability to boot from USB or SD card

Available
tails.boum.org/download

Over the past year, Tails has been going from strength to strength, completing important updates to make it a complete product. Version 1.1 in particular has updated the codebase and some of the camouflage features to make it more accessible and give it a longer lifespan.

Since then, a lot of the updates seem to revolve around usability. Not just in the terms of workflow and privacy, but also making private ways of performing day-to-day activities easier. There have been bug fixes and package updates along the way and while they're important from a security perspective, the ability to let people be private when they need to be and not hold them back from their life is the entire point of Tails to begin with.

Tails 1.3 is similar in this regard. On launch, you'll get the same excellent set of default options that immediately connects you to Tor, enabling secure browsing. You can also set the root passwords and activate the Windows 8 camouflage, along with advanced MAC spoofing and other proxy settings before you even load into the desktop.

The desktop itself is more or less the same, although it has cut down on the notifications about what's being set up, for ones letting you know what is ready. For most this is fine and we found the others fly past too fast to need to be mentioned. The new additions are mainly the Bitcoin wallet Electrum that lets you transfer money with minimal setup for accessing your wallet, and Keyringer where you can send 'secrets' via text documents in PGP mail and Git.

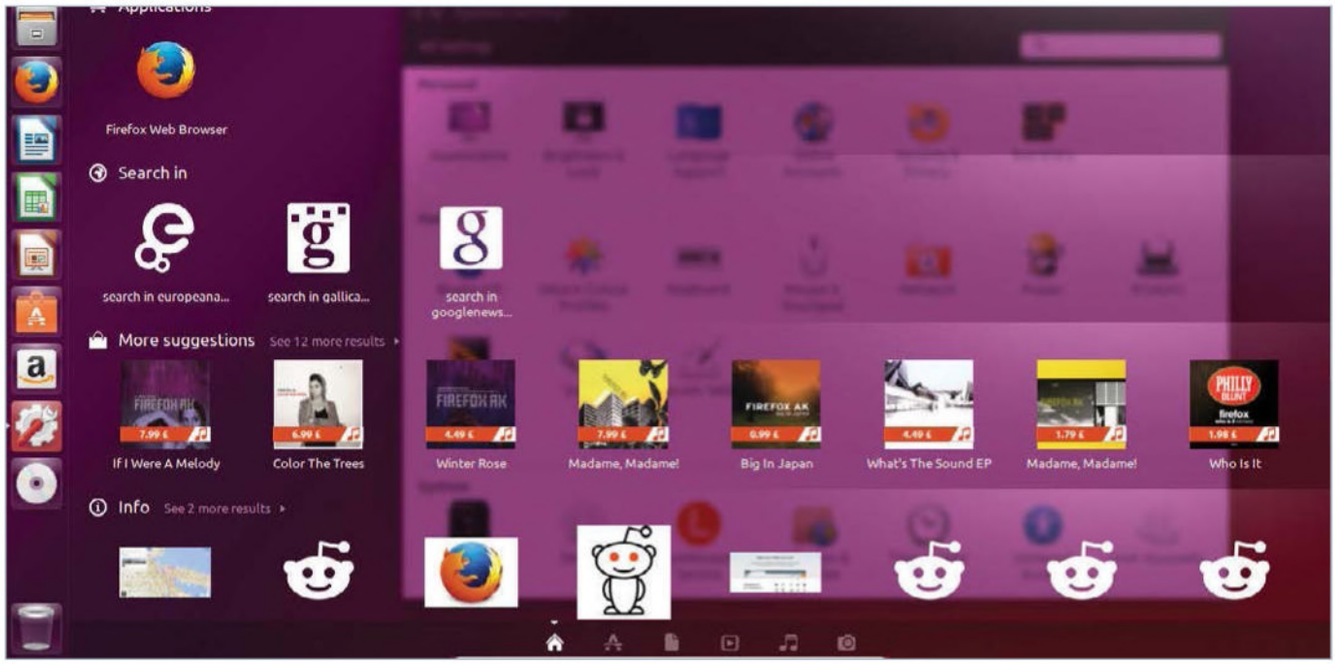
Both work well and perfectly with Tails, although as the devs like to point out, while Electrum makes it easier to transfer Bitcoin it is still very traceable.

While they are the big new things, there are small privacy and security increases that make the experience better. Our only small gripe is that installation is still a bit odd, but that can be worked on in the future.

Summary

While it's only minor improvements and additions, it's still a very secure and private distro. It is now easier to be on the Internet and remain private using Tails, thanks to Electrum and Keyringer bringing a better way to pay for things and securely transmit messages





Above Unity is back and with a slight change people have been asking for

Ubuntu 15.04 Final Beta

Ubuntu finally makes the switch to systemd. Is it the literal Devil or just a way to handle init?

By the time you're reading this, the full version of Ubuntu 15.04 will be out. This beta release of the distro is more of a release candidate in some ways and all the promised features are already intact and fully tested – a good sign for a new release of a distro. As a release midway between two LTS versions, there's not a massive amount of fanfare for the Vivid Vervet, but it's got some interesting new additions and changes nonetheless.

There are a few tweaks on Unity, which is now at version seven. One of the gripes with the way it handled windows before was how it always put the menu toolbar on the top bar. While it made sense in full-screen, when you have a few windows open it can take a moment to click that you're looking for the tools in the wrong place, and it didn't save much room at all. By default, it now has the tool menus docked with the window when it's not full-screened, enabling for a traditional and natural workflow.

On the surface, aside from minor tweaks and package updates, that's really the only main difference in the way you'll be using Ubuntu from the desktop. Go deeper down and we find the big change for Ubuntu 15.04: the switch to systemd for init. Upstart, the service it replaced, was an Ubuntu-own daemon as it was. Systemd may make it more universal in comparison, although with the murmuring controversy surrounding systemd, this may not be to everyone's taste.

The change makes little difference to the normal user experience. Unlike the days of weird security bugs that would pop up in systemd when using Fedora, a lot of those kinks have been ironed out and result in the same performance. As for the developers, it's stock systemd without really any Ubuntu modifications outside what's necessary for it to run – in this case, it will be down to where you fall on systemd.

Ubuntu 15.04 then is a pretty standard Ubuntu update – it looks prettier, it works a little better for the majority of users and there's a little 'fix' for one of the Unity complaints. Otherwise, it may be time to learn how to use systemd.

CPU
1 GHz

RAM
512 MB minimum, 1 GB recommended

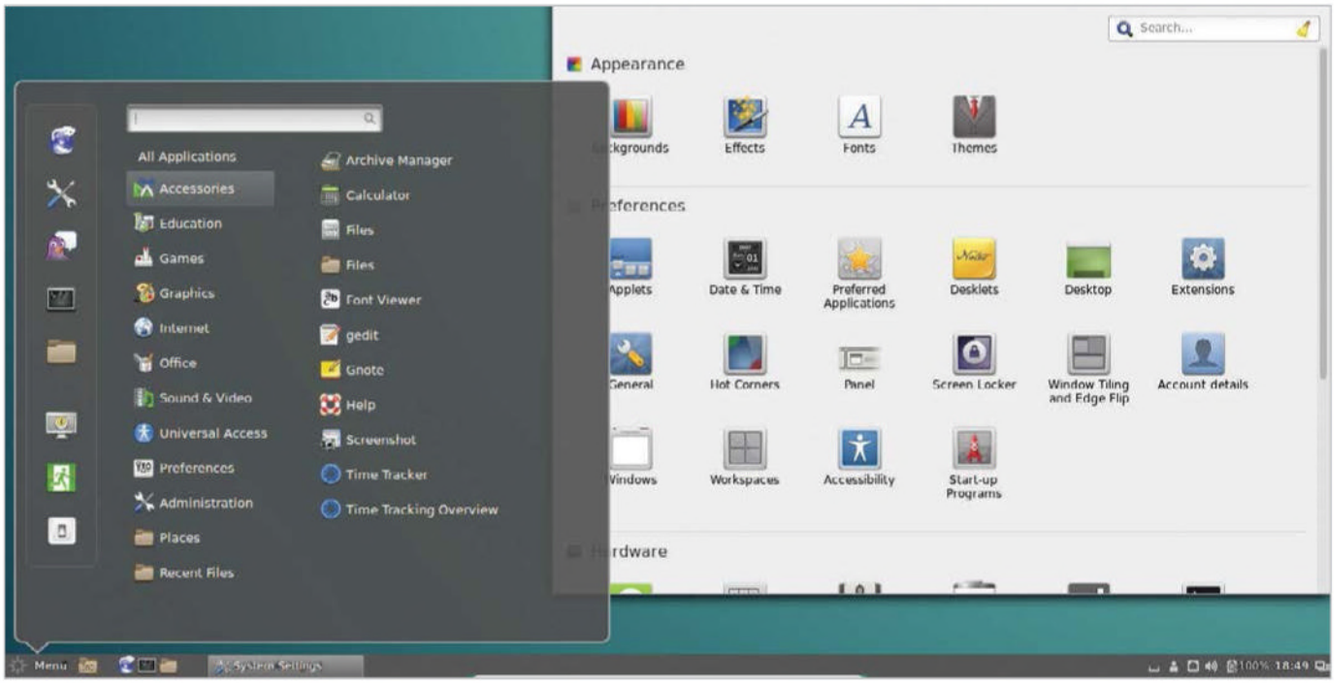
Storage
7 GB minimum

Available from
releases.ubuntu.com/15.04

Summary

While not a necessary upgrade from 14.10 – and really, if you're that against systemd then it's best to stick to 14.04 – it still offers enough so that when you do upgrade, you'll notice a slightly better selection of features and apps.





Above Jessie gives you the option to install the Cinnamon desktop

Debian 8.0 Jessie

Jessie has gone stable, and this new LTS release for Debian seems to have spent only a short time at the testing branch

CPU
1 GHz P4 or later

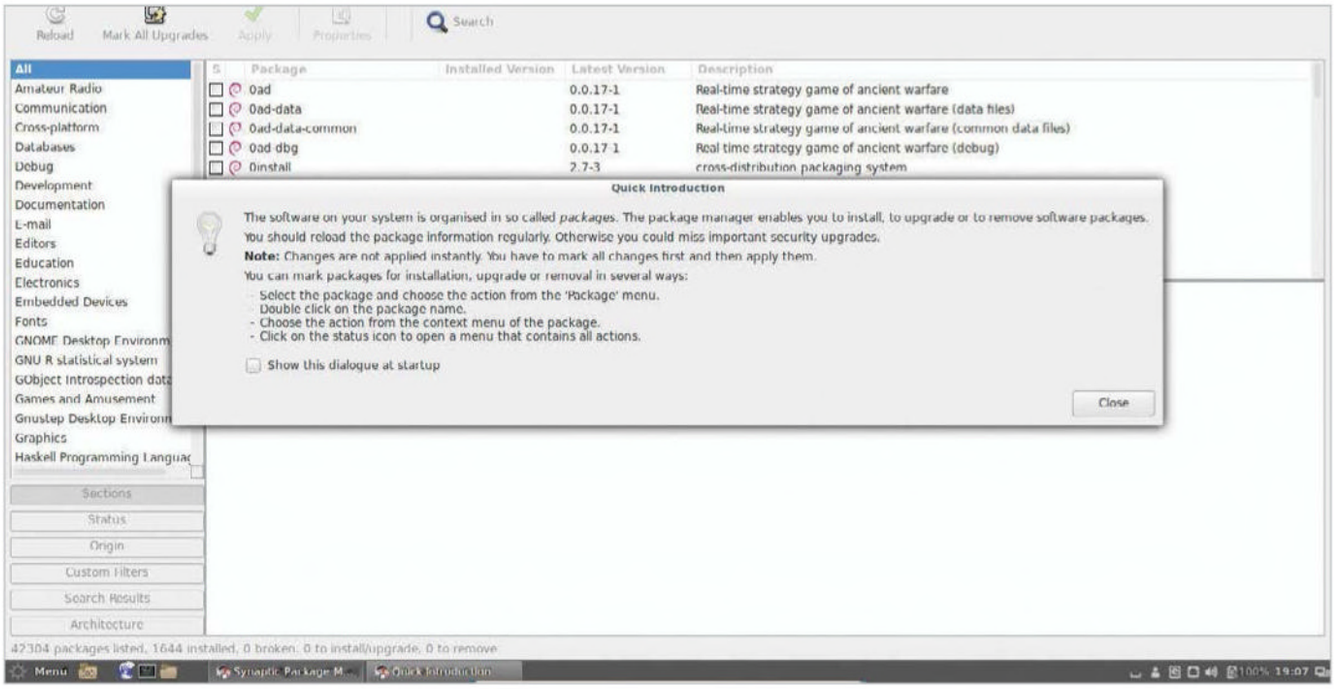
RAM
1 GB recommended (for desktop)

Storage
10 GB (for desktop)

The Debian cycle seems to be extremely short this time round. 7.0 Wheezy felt like it was in testing for a long time, yet already we've had 8.0 Jessie supersede it as the next stable. It's odd to think it's been two years since then, but here we are with 8.0 stable and the latest LTS release for the venerable Debian distro. With Stretch the next testing build, and probably the one we'll see used most in desktop distros, what is the actual stable release like?

First off, if you've been using Jessie over the last few months for any extended period of time, you will probably know what to expect. With the feature freeze in November, the five months leading to release were mostly bug testing to make sure that the final product was worthy of the stable name. It's definitely succeeded in this, being able to run well on a variety of hardware types and in situations where it's using a slightly wrong kernel for the hardware, such as with PAE support issues, for example.

Debian is very much a basic distro in that it offers you a base, graphical distro with a good selection of software installed and decent tools to expand on it to make it anything you want. There are no special, homegrown desktop environments, package managers, software centres or external services and such. It comes in a variety of flavours to suit many people's needs, including the now standard 32- and 64-bit spins, a variety of desktop editions and a command line version for those who want to start basic. Debian 8.0 continues this trend, albeit now giving you more up-to-date software packages and a few more options such as Mint's Cinnamon desktop.



Above Synaptic still takes care of your package management

"Installation is straightforward, using a simple graphical installer with the live desktop versions that offer enough control and options to create a very decent system"

Installation is straightforward, using a simple graphical installer with the live desktop versions that offer enough control and options to create a very decent system before you even log in for the first time. It takes a bit more babying than modern Ubuntus and Fedoras, but the actual installation process is not particularly time consuming on a medium-to-low powered modern system.

Using Debian once it's installed is as advertised: stable. We had no issues using it in day-to-day situations. By default there's a fair bit of software installed on the distro, so you can quickly get started with any work that you wanted to do. Package management in the desktop environments is handled by the old faithful Synaptic; this also includes any software or other updates for the system, which you'll have to remember to do yourself rather than relying on a pop-up notification.

Another addition to the stable branch that's particularly notable over Wheezy is the switch to systemd – it looks as though this year will continue the trend of distros adopting this as their new system manager. From a general user perspective, it won't matter to you at all. You can still continue to use Debian as your operating system without everything upending itself.

As for devs, Debian does at least offer users the choice of rolling back to an init-based system, so if it's being that egregious, you do at least have the choice for the next five years of long-term support.

Right now, Jessie is great, it is light and offers a range of options for every kind of user. Testing may still be the preferred distro for some though, as software inevitably becomes outdated over time, which can be an inconvenience.

People who are looking for a stable distro to serve them over the next few years will be more than happy with this version of Debian 8. There is even more choice available and a lot of the software is at an excellent up-to-date state.

Pros

Stable, reliable, comes with a great selection of software and is very easy to customise to your individual specifications

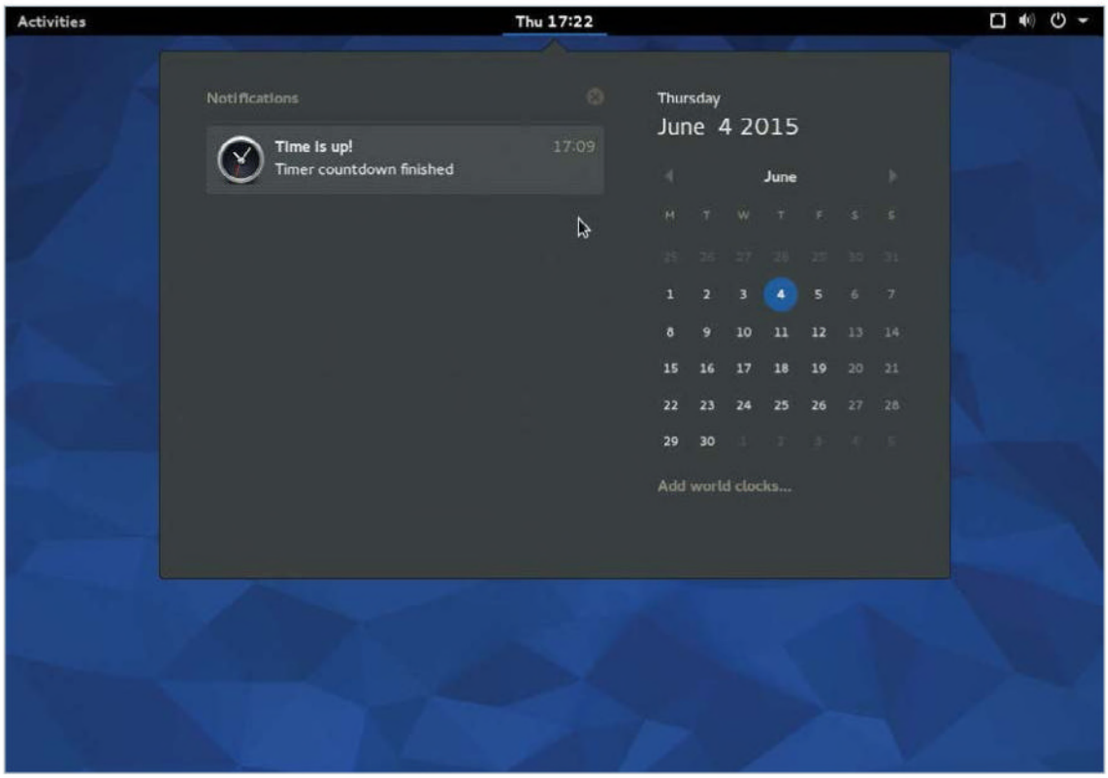
Cons

Aside from security updates, Jessie will remain at this level of software for the duration of its time as stable

Summary

Debian 8 is a fine new stable in the Debian line of distros, perfect for all kinds of users for at least the next six months, while still excellent for those who like ease of use, familiarity and good security on one distro for a more extended period of time.





Left As well as see your notifications listed here, you can interact with them as they appear via buttons on the banners

Fedora 22

Fedora branches into three distinct variants for its latest release, building on the solid foundations laid in Fedora 21

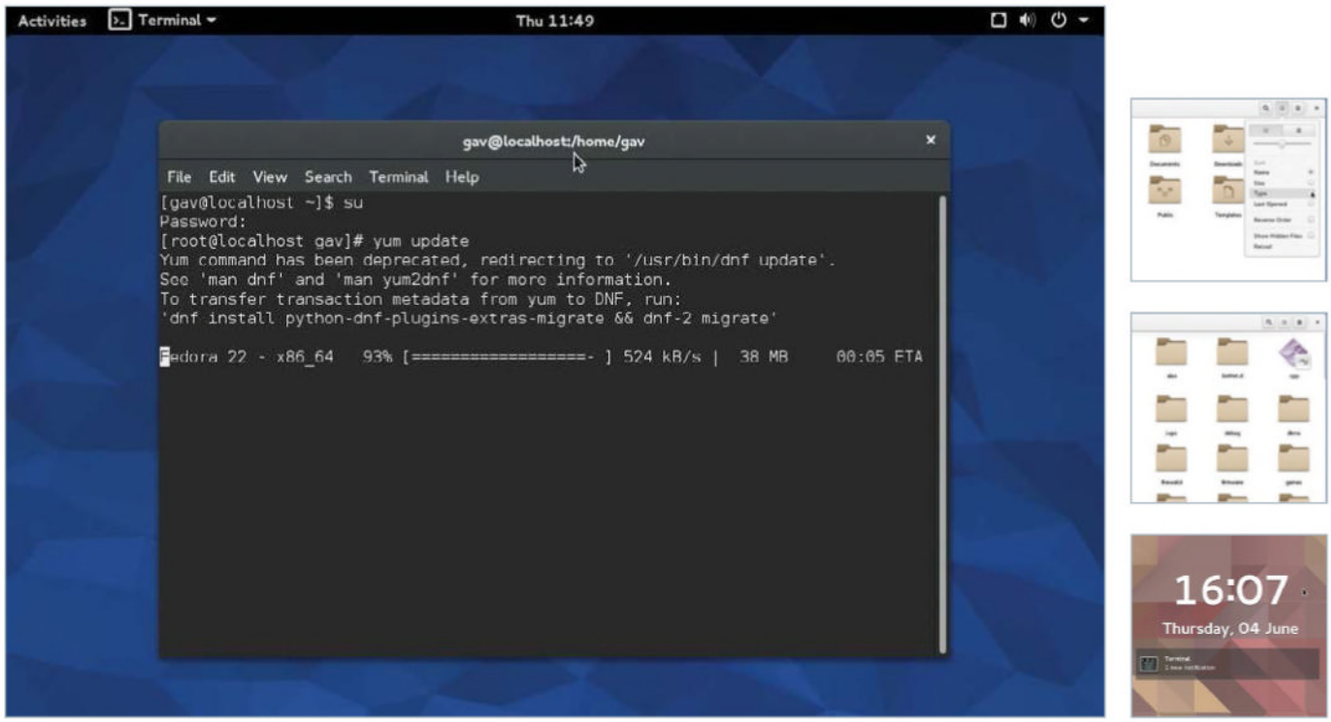
CPU
1 GHz

RAM
1 GB

Storage
10 GB

In the words of the developers, "If this release had a human analogue, it'd be Fedora 21 after it'd been to college, landed a good job, and kept its New Year's Resolution to go to the gym on a regular basis." Fedora 22 isn't a huge departure, but it does introduce some great features and expands on those brought in for the previous release. There are now three separate editions of the distro, each tailored with packages to suit its purpose: Cloud, Server and Workstation. We're focusing on the latter here, the desktop edition, although there are some noteworthy features in the other two, including Docker images and Vagrant Boxes for Fedora Cloud and a default XFS filesystem on top of LVM for Fedora Server.

Vagrant has also been added to Fedora 22 Workstation, continuing the focus on virtualisation for this cycle, while the UI for Boxes has also been totally revamped with a better box creation assistant, new preferences, default display scaling and a new feature that lets you send keyboard shortcuts through to a box. In terms of software there are some other improvements with Fedora. KDE Plasma 5 and LXQt have both been packaged for this release, there's a brand new IDE for GNOME called Builder, including features like split-panel editing and a Markdown preview, and there's a new Preupgrade Assistant that assesses your system to ensure it's ready for the next upgrade. At the back end, Fedora is now a step closer to running on Wayland, with the display server being used for the GNOME Display Manager in this release (although the GNOME session still uses X), and the Elasticsearch indexing server has been integrated with the Fedora repos.



Above For a full breakdown of Yum/DNF differences, check out **http://dnf.readthedocs.org/en/latest/cli_vs_yum.html**

"DNF is an improvement over Yum, using the dependency solver hawkey and then librepo for repo operations and libcomps for package groups"

Perhaps the biggest change in Fedora 22 is the replacement of its package manager Yum with DNF (Dandified Yum). DNF is a real improvement over Yum, using the dependency solver hawkey and then librepo for repo operations and libcomps for package groups. DNF will also skip over updates and repos that don't work without halting the entire operation, it makes the update and upgrade commands equivalent, and it will also remove dependent packages that were not installed by users. For now, Yum is still aliased and you'll see a reminder that it is now deprecated if you try to run a Yum command, but then the DNF equivalent of your operation will run, which is handy.

Some great changes have also been brought to Fedora courtesy of GNOME 3.16 – chiefly, the new notification system. Notifications are now displayed at the top-centre of the screen instead of the bottom, and these have been integrated into the calendar popover where you can clear them individually or all at once. Another nice touch is that the terminal notifies you once long-running jobs are complete. GNOME Shell and other themes have seen a number of improvements too, from small touches like the way that window resizing and placement works, through to more integration between different desktop environment themes, so apps from other environments feel more like native apps.

Files has a new popover that enables you to set the zoom level and sort order, and you can now send files to the trash using the Delete key without having to hold Control. Scrollbars have also been replaced with a new overlaid scroll marker which is slimmer and minimal, designed to keep out of your way until you mouseover, at which point the full scrollbar appears. You also have dotted lines along the top and bottom of your windows to indicate further content, and there's a pulse when you hit the top or bottom, all of which are small, but very welcome touches that enhance your user experience in a subtle but significant manner.

Pros

The new GNOME 3.16 features and the DNF package manager are highlights, and the three editions are well suited to their purposes

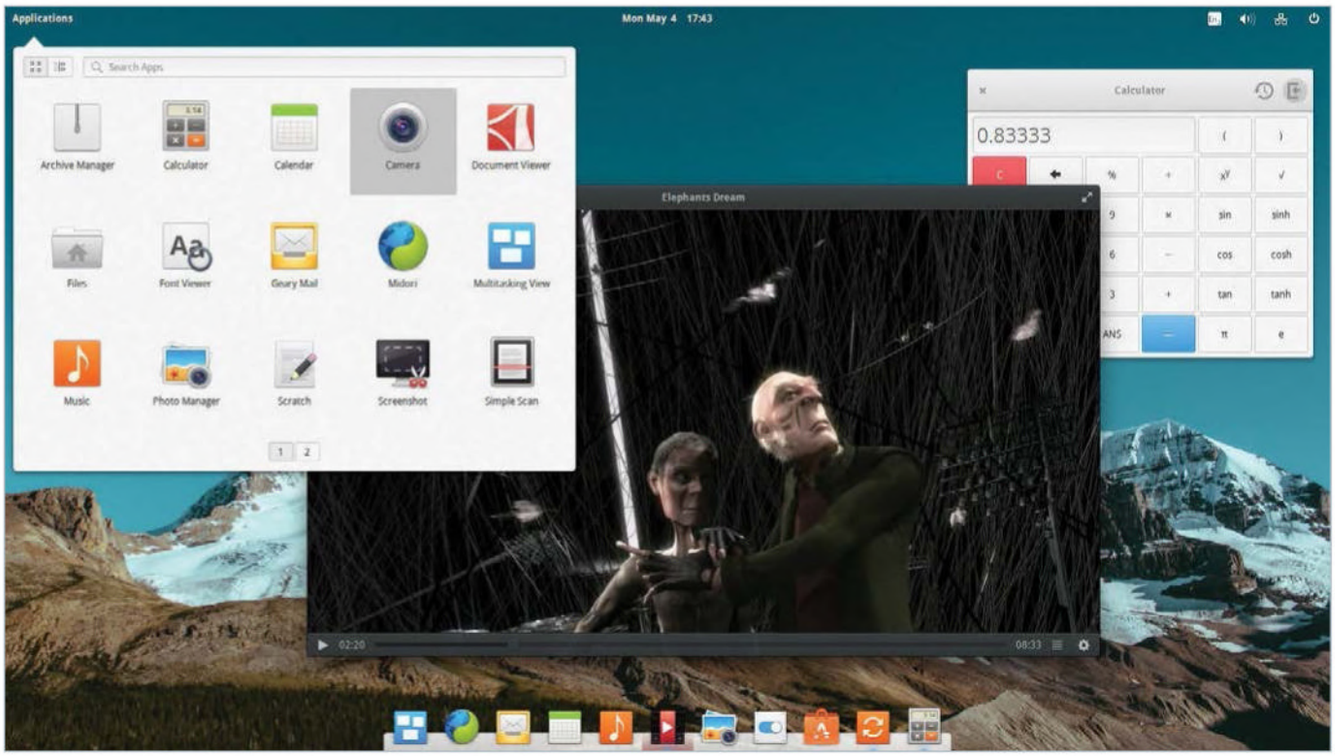
Cons

It's hard to fault this release – it's a solid improvement on Fedora 21 and the switch to DNF has been very well implemented

Summary

Virtualisation is now easier across all editions of Fedora 22 and DNF should prove to be a worthy successor to Yum. Factoring in the subtle but important design changes and new features, this release is an excellent progression for the distro.





Above The Videos, Camera and Calculator are new additions for Freya

elementary OS 0.3 Freya

Over 1,100 improvements make Freya the biggest elementary OS update yet

CPU
1 GHz

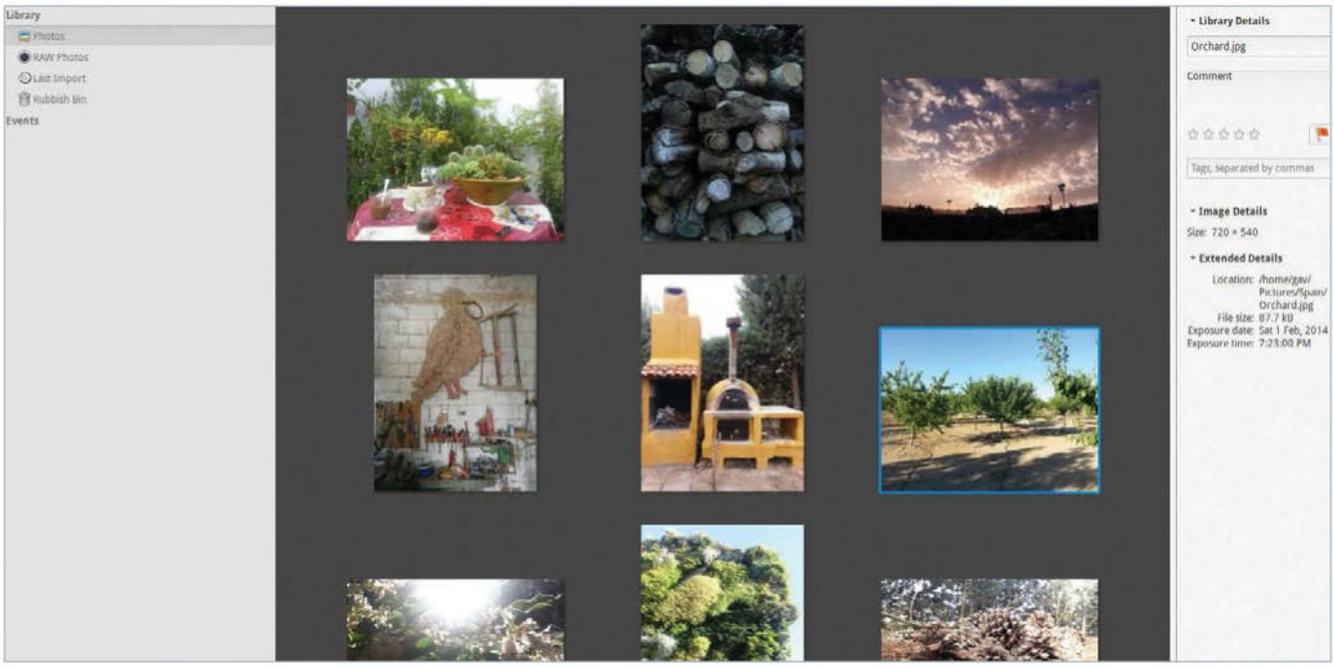
RAM
1 GB

Storage
15 GB

Elementary OS has continued to impress in the four years since its first release and almost two years since Luna, its last major update at version 0.2. The developers claim over three million downloads and elementary OS has remained in the top ten most searched-for distros for the last year, with a strong community continuing to build behind this enduringly popular distro. Freya, based on Linux 3.16 and the Ubuntu 14.04 LTS, brings a host of visual changes that are largely based around improvements and additions to Pantheon, the Ubuntu-based operating system's desktop environment that replaces Unity.

Much of the change is in the smaller details, with work being done on things like the rounded corners of dialogs and the lights and shadows of panels, reducing gloss tones for a more matte look, and also in the context-sensitive header bar that adapts its colour and transparency depending on what you have open in order to be non-intrusive. Slingshot, the application menu, has also been improved with the capability for simple calculations in the search bar and the ability to drag-and-drop app icons from your searches.

One of the biggest changes is the redesigned multitasking screen, which now has (like many aspects of elementary OS's design) an even more GNOME 3 or OS X feel to it. It's now right up front in the dock and as well as select and close your open applications, you can also switch to different workspaces using the buttons along the bottom – this entirely replaces the workspace switcher that used to push up from beneath your dock, making for a much tidier solution (though you can still use your hot corners for switching workspaces).



Above Photos has been redesigned since being forked from Shotwell

"The developers claim over three million downloads and elementary OS has remained in the top ten most searched-for distros for the last year, with a strong community building behind it"

Along with a new unified lock and login screen that has a great clock widget, there's also an updated notifications system that comes with a 'do not disturb' mode. The notifications are interactive and they'll also show you alerts from things like terminal processes that are running in the background. Regarding the terminal itself, this now has labels for the tabs along the top that each show the last command that you've run and natural copying and pasting (ie Ctrl+C) now works in the terminal too.

Another big change from Luna is the redesigned Photos app. Forked from Shotwell earlier this year, which is helpfully written in the Vala language also used to write Pantheon, Pantheon Photos is now being run by the elementary team and has been given the same attention-to-detail treatment as the other Pantheon programs to make it as intuitive as possible. Joining Photos in Freya's line-up of core software is a new Videos application, as well as a new Calculator and a Camera application for webcams.

Look in the System Settings and there are a few final changes of note, including redesigns of the date and time, user accounts, applications and displays menus, again to simplify and visually improve the options. The privacy settings page now has a toggle at the top for a privacy mode, which you can enable if you want to stop elementary OS itself from tracking your usage data, and there's another new toggle switch for a built-in firewall which supports custom rules for enabling and denying traffic.

Altogether, these minor and major additions to the operating system make for an incredibly strong release that definitely adds to elementary OS's reputation for clean, elegant simplicity in its user experience while also modernising its design and updating the software selection. It's as fast and lightweight as it has ever been, making it suitable for old machines, and Freya is a pleasure to use and tinker with no matter which operating system you are used to working with.

Pros

Design and menu improvements throughout Pantheon, new and overhauled software, notifications, firewall and privacy mode

Cons

May be just a bit too limiting for users accustomed to greater choice and customisation options in their distro

Summary

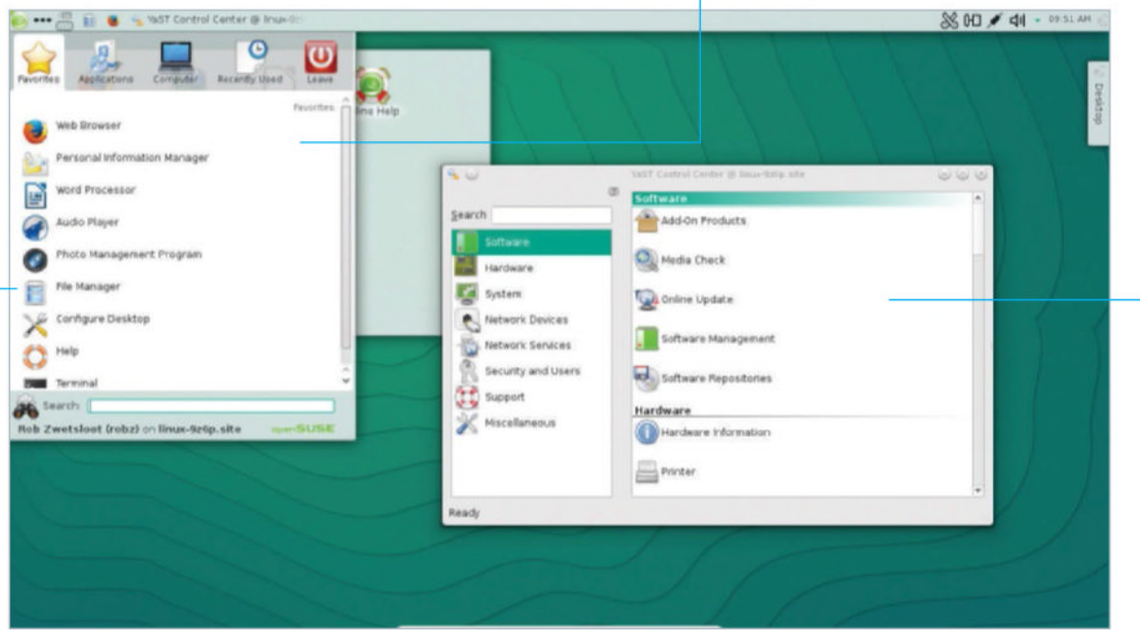
Freya's host of updates brings improvements across the board, from new core apps to a firewall and simplified workspace switching, making the new release a clear progression on an already brilliant distro that has a lot to offer to Linux newcomers.



App selection in openSUSE is very good, with a packed selection of default apps and a full repository

KDE and GNOME are still the standard desktop environments, and have been themed and tweaked by the developers

There are a selection of standard updates and bug fixes, but YaST is now completely written in Ruby



openSUSE 13.2

A look at the release candidate for openSUSE's 13.2, the next step in the Linux distribution for everyone to use

Pros

This version looks a lot nicer and generally is much nicer, being right back on track for openSUSE

Cons

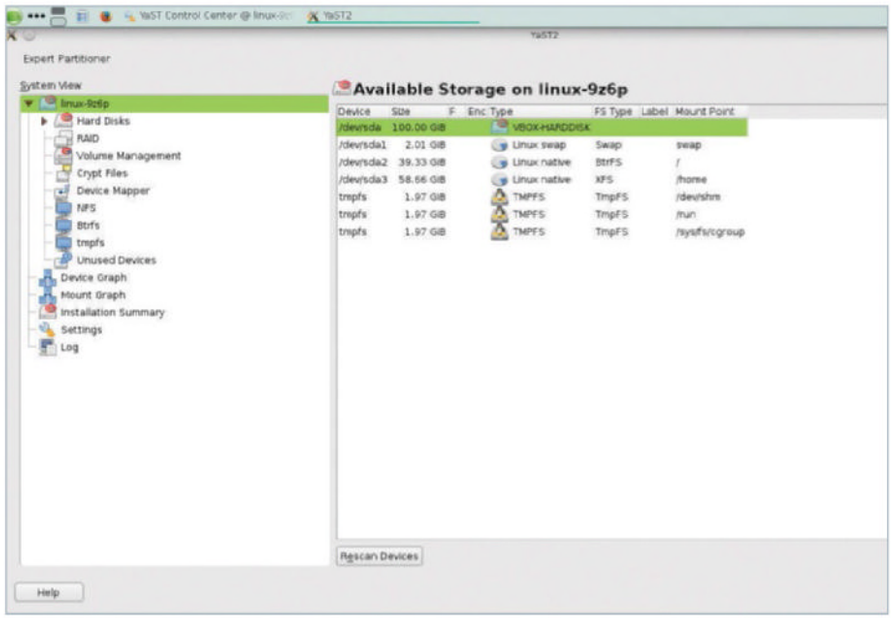
Not as easy to use as others for newcomers, and focus on aesthetics may have taken away from tech

After a year of more focused polishing under new guidelines, OpenSUSE 13.2 is set to be the most advanced and best looking version of the distro yet. OpenSUSE has always been one of the most unique distros on the market that has maintained popularity for some time now. Of course, as a testing platform for the technology that will eventually find its way to enterprise SUSE, it does have that link to Fedora. However, openSUSE tends to test these at the discretion of SUSE, and is mostly its own independent distro. Also, like Fedora, it concentrates on using only purely free and open source software (FOSS) in its repositories. That's where any kind of minor similarities end though, as the way openSUSE works and functions is different still. That's not to say it's a completely alien experience.

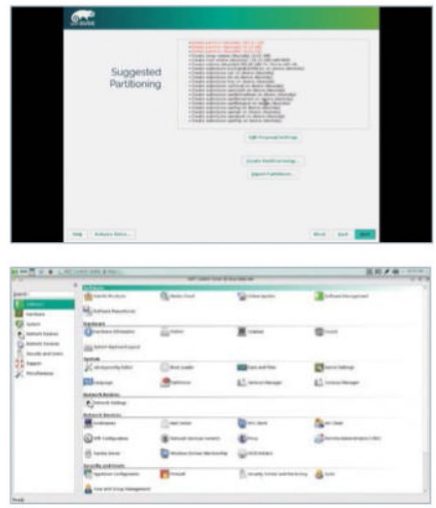
It still uses some of the standard desktop environments that come with other Linux distros so you should be fine making your way around the distro. The main difference is the way it handles package management, geared more towards developing, and a unique way of installing via web. There's also an all-encompassing settings menu that goes deeper than almost all other graphical setting interfaces.

One-click installing

This interface, know as YaST, is one of the many ways you can go about installing packages in



Installation from the full DVD allows for a complete and customisable install, while the live CDs offer a great preview



System information is easily accessible, allowing for system diagnostics on every level

"OpenSUSE is also about community, and the changes to YaST and efforts made with Btrfs are a great indicator of how strong it currently is"

openSUSE. Not only can you install, you can also add repos, check package versions and meta-contents, or even just enable or disable repos. It can blend seamlessly into the YaST system, however it does require getting into it to add software in this way.

You also have the choice of zypper on the command line, the alternative to yum or apt-get that runs very smoothly and can be much more readable than the other two. Finally, you can also find software you like online and click an installation button from your browser. This is similar to how you can remotely install apps to an Android phone via the Play Store browser. It's a very nice addition, and something that most other distros don't include. Having three fully functioning ways to install and manage your packages is an excellent way to give extra choice, and in openSUSE's case it doesn't bloat the system.

Future innovations

This release of openSUSE also brings with it two new technologies that are quickly becoming Linux standards: systemd and the btrfs filesystem. Systemd is much more ubiquitous among the various Linux systems, with btrfs slowly gaining steam through kernel advancements, Fedora support and now openSUSE.

The greater support for systemd here will be seen as controversial for those that are invested in the init system of Linux distros, however openSUSE has gone to great lengths to try and wrangle it into a more usable form via extra modules and settings in YaST that can be used to customise it.

Btrfs on the other hand doesn't carry that extra baggage, and you can choose between other file systems if you wish. Btrfs does offer extra features though, thanks to advanced version control, sub-volumes and being able to back-up and roll-back easily with ext filesystems. The implementation in openSUSE is also excellent, especially in 13.2 where extra effort has been put into it.

As well this new general Linux tech, openSUSE also includes a new piece of software called dracut that has significantly cut down the boot time, and has made sleeping and resuming almost instantaneous on some setups. Users can now also access Plasma 5.1, the very latest release in the KDE desktop line that is beginning to take shape as an excellent next-gen desktop.

Usage scenario

Actually using openSUSE around all these features and software seems like a renewed experience. For the last couple of years, something's felt off with the distro, and it didn't help that the community was having trouble getting people in to help build and test it. Since 13.1's release, a styleguide has been introduced and the last year has been spent bringing 13.2 up-to-scratch while still being able to showcase some of the latest and great FOSS technology.

It can be a little intimidating for those that are not used to the variety inherent in Linux, and it's definitely not something you could recommend to a newcomer. However, for those with some knowledge of Linux, openSUSE is an excellent distro that makes desktop Linux use quite easy once you learn the ins and outs.

Summary

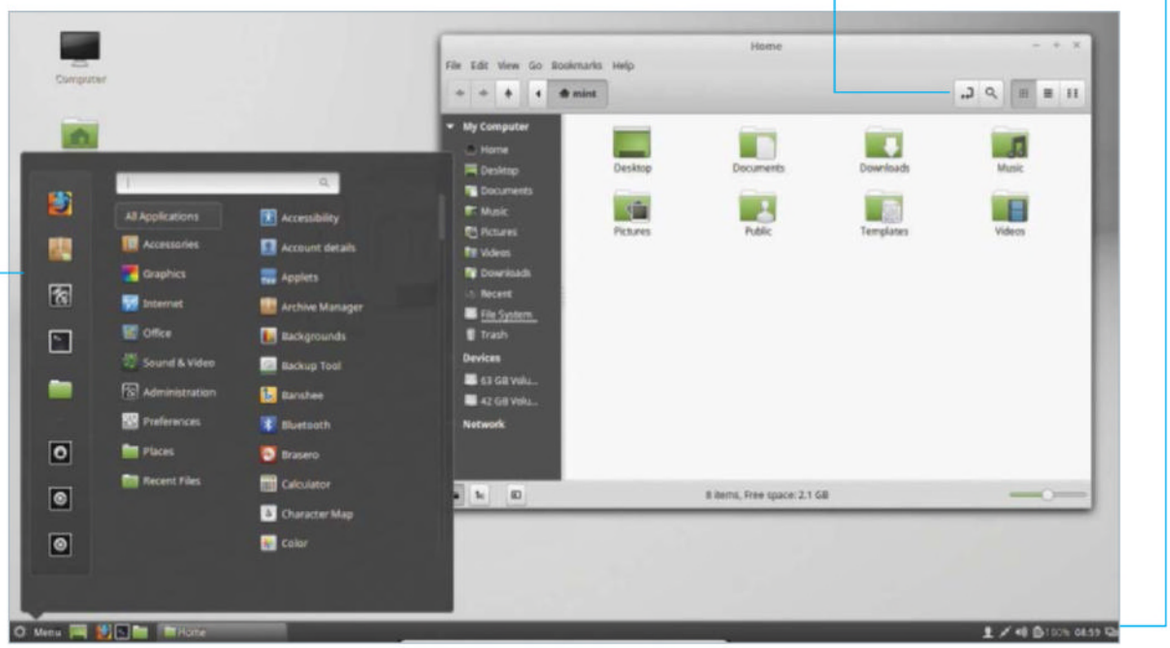
This is a return to form for the distro that has had some issues getting out the door, let alone being stable, in the last few years. The year of focus on polish with the new guidelines have worked wonders.



Slight changes to the transparency effects and colours make navigating the already great Mint Menu just that bit better

Edge tiling is improved with a new lock feature that means windows you wish to stay visible always will

Cinnamon 2.0 is very stable, even with its own brand new back-end



Linux Mint 17.1

The Cinnamon-flavoured revolution is here as Mint releases its first truly independent desktop environment

Pros

Improvements all-round and the addition of the kernel selector will be useful to some of the specific users

Cons

A minor update in general though, and barely worth doing if you're already running Mint 17 and are happy with it

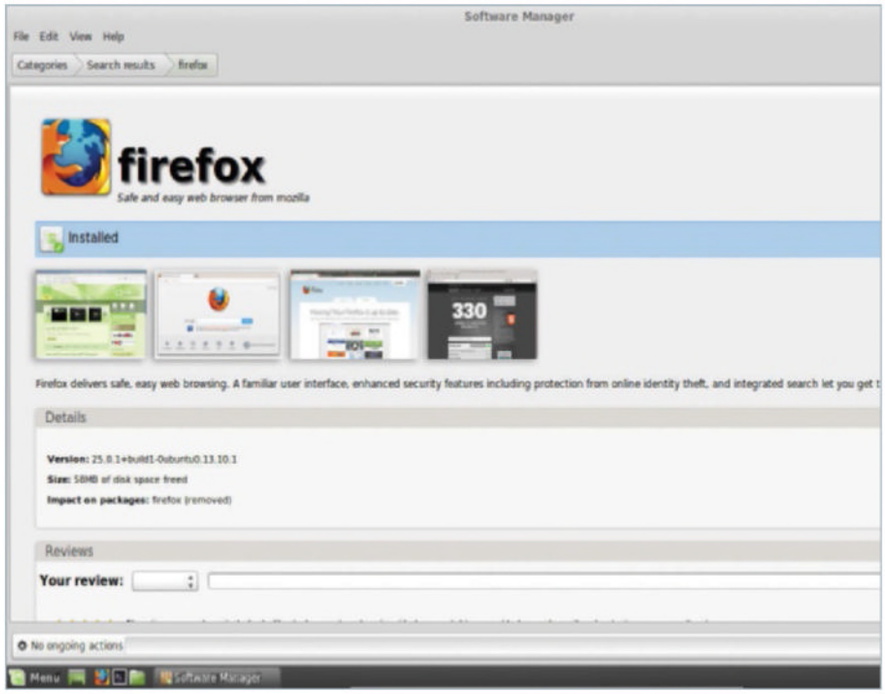
The Linux Mint team's latest version of the distro is their first long-term support release based on Ubuntu 14.04 – 17.1 comes with some much needed updates. For the first time ever, Linux Mint has received a full-on point release update and in more unique is the fact that this 17.1 comes instead of the Linux Mint team working on a Linux Mint 18. Linux Mint 17, for the first time in the distro's history, is a long-term support release based on Ubuntu's own current LTS, 14.04 Trusty Tahr. With no new numbered Linux Mint coming until 2016, it's good to see actual quantifiable evidence that the Mint team not only still exist, but are keeping with their LTS promise.

As such, on first glance, there's not a massive difference in 17.1 over 17. The core of the distro has received a series of security and bug fix updates, with all default software now updated to their latest versions at the time of release as well. In terms of the desktops, all versions have had tweaks to the updaters and other settings – the software updater now allows you to try and streamline the list of updates, grouping together sets of updates to supposedly make reading the list easier. The main benefit of this we've found is that you no longer need to hunt down every single package that's part of a piece of software if you want to delay updating it.

Choose your kernel

As the distro ages and receives kernel updates, it seems the team has noticed the need for a way to choose between the different kernels; this can be essential for people who need to do development on different kernel types, or if you just need to rollback for specific security or compatibility reasons.

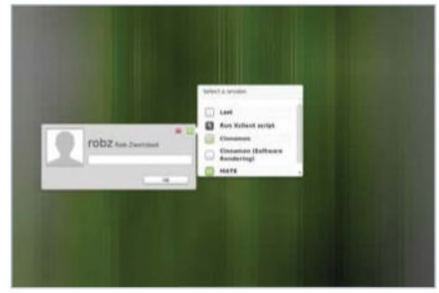
The desktop environments, while not getting any specific major new features, have been updated nonetheless. Cinnamon 2.4 has had a focus on a 'smoother experience',



The Software Manager is one of the things that separates it from Ubuntu, with no ads or paid apps. It's had a few minor updates, including the ability to show off more screenshots



MATE is still at 1.6, but it's a great desktop and a solid choice for a Mint install nonetheless



MDM has come on in leaps and bounds since its first introduction, and this release is the first time it's seemed truly modern

"For those new to Mint, this is still one of the best distros out there"

which comes in the way Cinnamon handles itself slightly more efficiently. On the kind of modern systems we'd recommend Linux Mint with Cinnamon for, it's barely noticeable with normal use, but on older systems there is a benefit.

Along with further polish like handling the system sounds better, adding the ability to open the home directory any time by using the super(/Windows) key plus 'e' at any given point. It's a minor improvement over the already excellent desktop environment, but at the very least it doesn't make the experience any worse.

On MATE, the other desktop that the Mint team work on, there's a similar level of minor updates, although there's now full support for switching to Compiz over the standard window manager out of the box.

Minor changes

It is a minor update over the original version of Linux Mint 17, but it's definitely a useful one for those that like to keep their software up-to-date. If you're already running Mint 17 you won't really need the update, but it's worthwhile for those jumping into Mint (or Mint 17 at least) right now.

For those new to Mint and perhaps Linux in general, this is still one of the best distros out there. Using all the traditional desktop metaphors and workflow that people will have learnt on every other type of computer helps allow you to get straight into using and enjoying the Linux experience. Cinnamon itself is probably the best new desktop of the past few years, taking modern parts of desktop environments such as search and software integration and giving an interface without compromise.

MATE on the other acts more as a continuation of slightly older (and lighter) technology to see it through. This one is aimed more at Linux veterans who don't like the direction of some of the more modern desktops, while still being able to squeeze in whatever new tech might improve the experience without getting in the way.

Linux Mint's use of Ubuntu goes further than just slapping a bit of branding and a different desktop environment on top of it though; the Mint team have a habit of completely overhauling certain aspects of the distro. There's a custom login manager that is much more advanced than lightdm or even gdm, allowing for better and more elaborate theming if you want it. On the desktop itself you have an excellent alternative to the Ubuntu Software Centre, along with better settings and generally more control and less bloat on the distro. Even with the change to LTS only, all this remains with 17.1.

Summary

Linux Mint 17.1 may only be a minor update over 17, but it brings with it enough improvements to warrant an upgrade if you've not been keeping your system up-to-date, or still on the edge of whether or not to get 17 in the first place.



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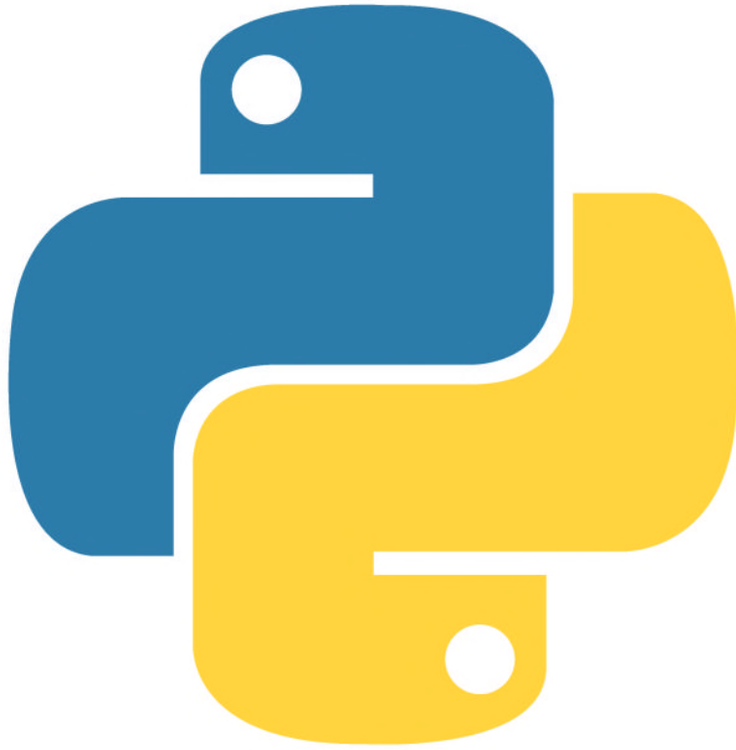
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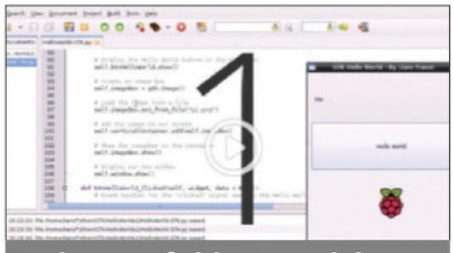
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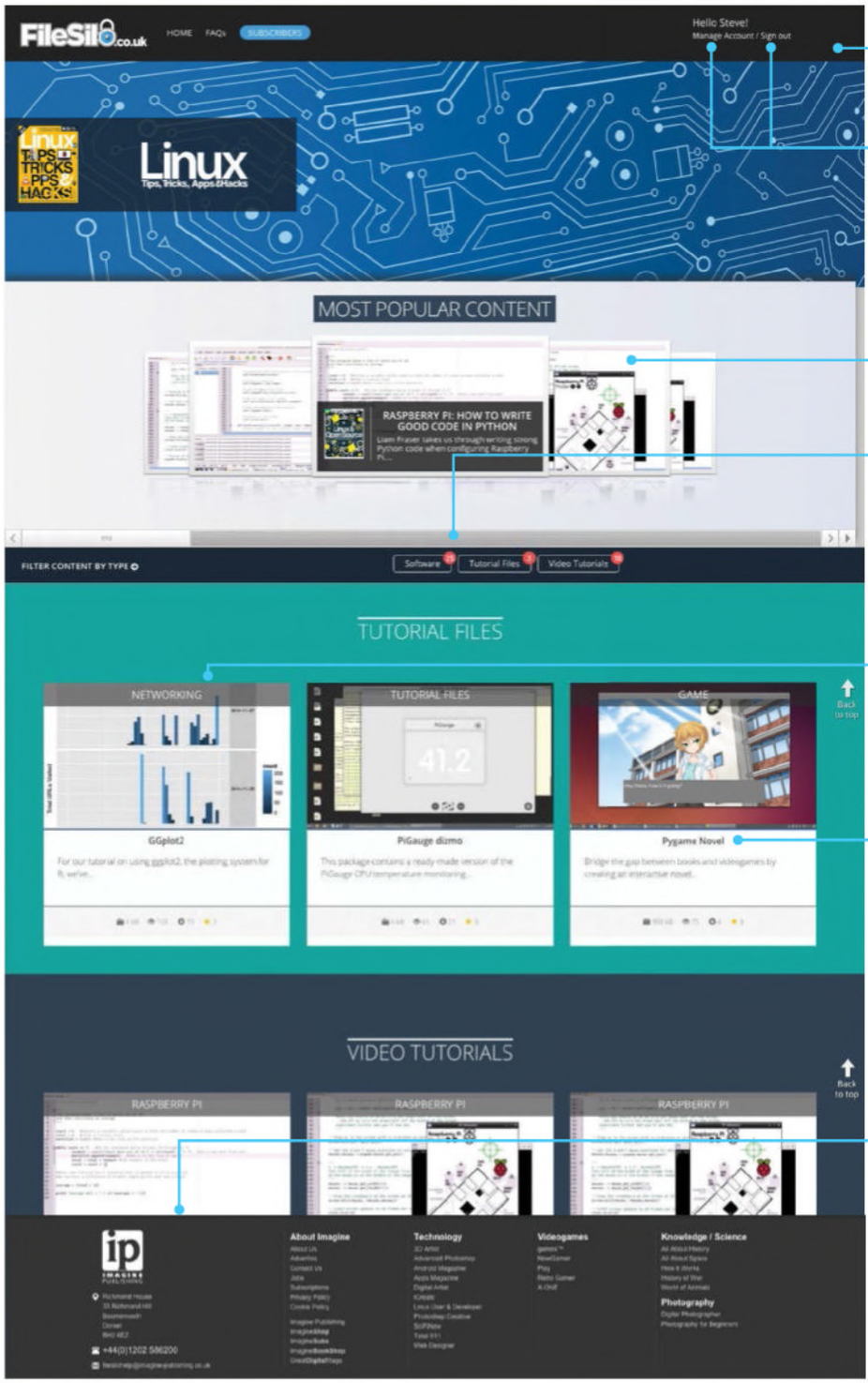
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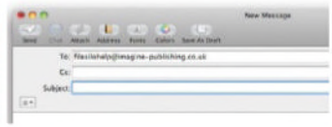
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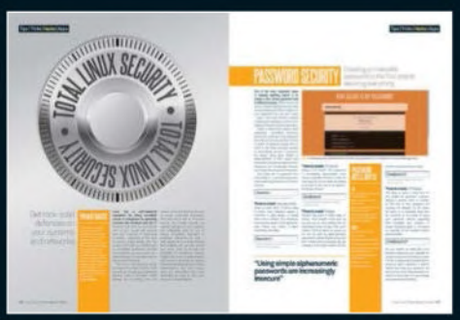


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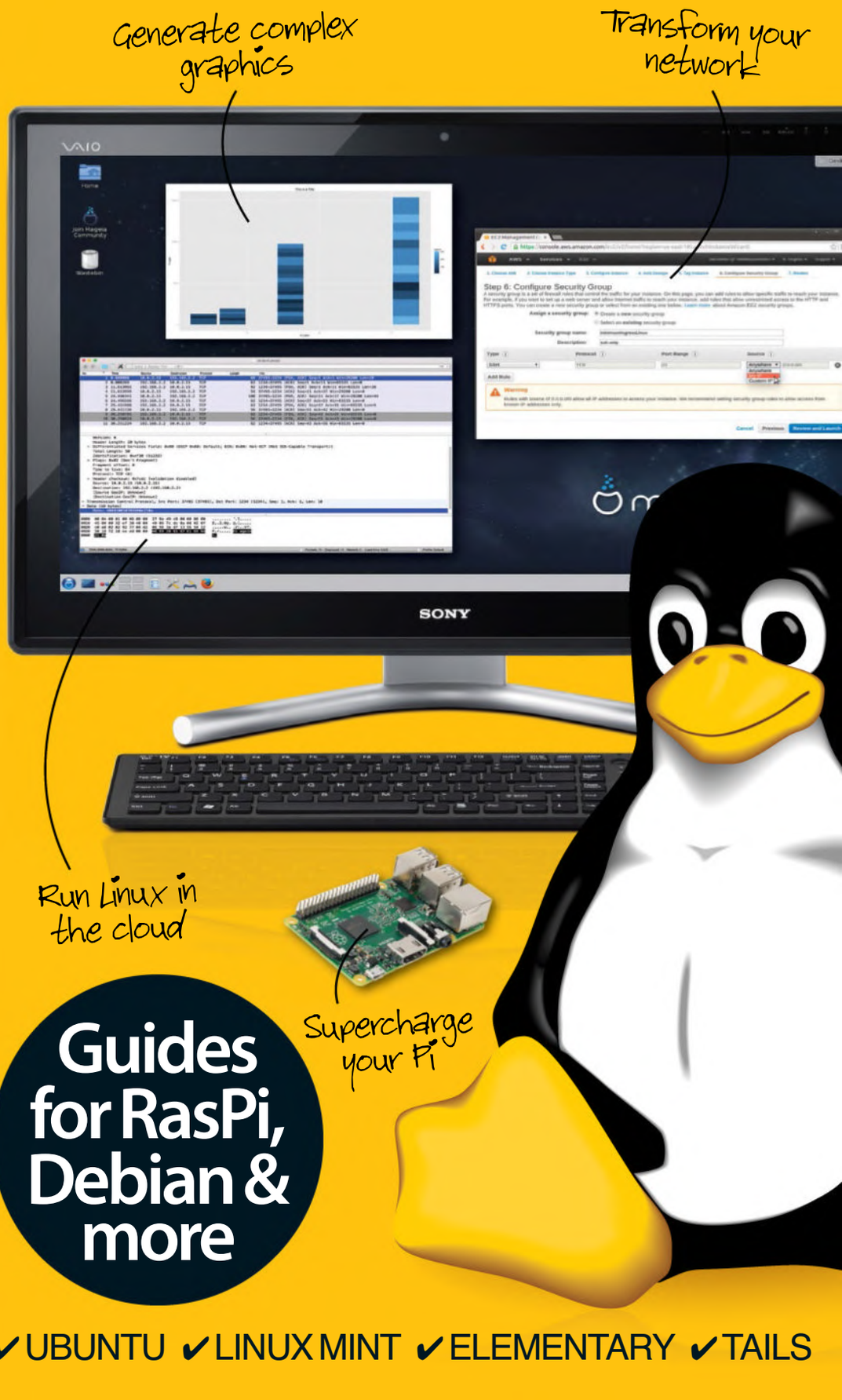
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